Equipment for Survey (Hand Used)

PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK						
Hand Over Equipment for Survey (Procured by JICA)						
Equipment Name	**Production Serial Number**	**S/N**	**Qty**	**UnityPrice (RWF)**	**Unity Price (Yen)**	**Total Price (Yen)**
Equipment for Survey						
Portable test meter	-	JS-1	2	1,520,913	200,000	400,000
Portable GPS	471047596	JS-3	5	243,346	32,000	160,000
Residual chlorine test meter	-	JS-8	2	64,639	8,500	17,000
Portable electric conductivity meter	2548936	JS-10	2	84,411	11,100	22,200
TOTAL (Equipments for Survey)				**1,913,308**		**599,200**

Date; 23th January 2019

For WASAC

PREPARED BY:

Mr. NTAMUTURANO Desire
Head of Leak Detection and Pressure Management

VERIFIED BY:

Mr. BAHIGE Jean Berchmas
NRW Manager

APPROUVED BY:

Mr: RUTAGUNGIRA Methode

Director of Urban Water and Sanitation Services

For JICA

Mr. ITANGISHAKA Vedaste
Assistant / NRW project

Mr. SHIGEO Otani
Chief Adviser of NRW Project and JICA Expert team

請求書

No. 00018340

PAGE 1

平成28年09月05日

151-0073
東京都渋谷区笹塚1-62-11
KECビル 2階
株式会社協和コンサルタンツ 御中

(J-AAA-00047837)

TEL 03-3376-3178
FAX 03-3320-6542

株式会社 佐藤商事

211-0063 川崎市中原区小杉町1丁目403番地
武蔵小杉タワープレイス5階
TEL 044-738-0622 FAX 044-738-0623
振込 三菱東京UFJ銀行 大倉山支店
普通 0869424 カ)サトウショウジ

商品コード / 商品名	数量 Quantity	単価 Unit price	金額 Amount	備考
防水ﾃﾞｼﾞﾀﾙ導電率計 EC HIGH	2	11,100	22,200	
Portable electric conductivity meter	1			
送料ｻｰﾋﾞｽ				

お支払期日:10月末日	税抜額	22,200	消費税額 Tax	1,776	合計 Total	23,976

※振込み手数料はお客様のご負担でお願い致します。(手形不可)

請　求　書

発行日
2016/8/25

〒 151-0073

東京都渋谷区笹塚1丁目62番11号　KECビル2階

株式会社　協和コンサルタンツ　　御中

愛知時計電機株式会社
国際営業部
名古屋市熱田区千年一丁目2番70号
TEL　(052)661-5150(直通)　456-8691
FAX　(052)661-6418

取引銀行
三菱東京UFJ銀行名古屋営業部　当座NO.110351

品番・品名		数量 Quantity	単価 Unit price	金額 Amount	備考
TR-Ⅲ	電子式テストメーター Portable test meter	2	200,000	400,000	出荷について：貴社お振り込みを確認させて頂いた後、出荷をさせて頂きます。
			合計	400,000	
			消費税 Tax	32,000	総合計 Total 432,000

ご注文番号	KEC第28-039号

送り先	〒 151-0073　東京都渋谷区笹塚1-62-11　KECビル2階 株式会社　協和コンサルタンツ 国際事業部　筒井様

請求書

平成28年09月14日　　No　07764507

株式会社 協和コンサルタンツ
筒井 様

354-0036 埼玉県富士見市ふじみ野東1丁目
7番地6
株式会社いいよねっと
代表取締役　真鍋　陽一
TEL 049-267-9114 FAX 049-267-9124

下記の通り御請求申し上げます。

■お振込先
※お振込手数料は申し訳ございませんが、
お客様にご負担頂いております。

お支払い期限 :事前お振込み

埼玉りそな銀行(銀行番号0017)
支店名　　ふじみ野支店　(支店番号 674)
口座種類　普通口座
口座番号　0289530
口座名義　株）いいよねっと
カナ口座名 カ）イイヨネット

請求金額合計　　¥172,800－

商品名	単位	数量 Quantity	単価 Unit price	金額 Amount	備考
150810					
rex30x 英語版	個	5	32,000	160,000	
Portable GPS					
＜税抜合計金額＞				160,000	
＜ 消費税 ＞ Tax				12,800	
検収確認済					
			合計 Total	172,800	

請　求　書

〒151-0073
東京都渋谷区笹塚1-62-11　KECﾋﾞﾙ　2F

鈴[illegible]株式会社
〒113-0033
東京都文京区本郷5丁目29番1号
電　話（3814）0875（代表）
ＦＡＸ（3814）0877
取引銀行　みずほ銀行本郷支店
当座 0103529

株式会社 協和コンサルタンツ
国際事業部　様

日　付	伝票番号	お客様コード	担　当	取引	通　番
28 9 5	6901				

区分	商　品　名	数　量	単位	単　価	金　額	摘　要
	Residual chlorine test meter SP-1 Quantity DPD法簡易型残留塩素計　SP-1	2		Unit price 8,500	Amount 17,000	
	Reagent 残留塩素DPD試薬分包　500回分	3		5,500	16,500	

備考	(坦)筒井様	対象額	33,500	消費税	2,680	合計	36,180

上記の通りご請求申し上げます。

Tax　Total

Equipment for Training Work on Pipe Repair and Service Pipe Connection, and Equipment for Pilot Project (Ruyenzi and Kadobogo)

Used in Two Pilot Areas

PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK
Hand Over Equipment List Used in Training work and in Two pilot areas activities (Kadobogo & Ruyenzi) (Procured at Rwanda)

No.	Name of Equipment	Specification	Unit	Quantity Used	Quantity procured	Balance to wasac store	Unit Price (RWF)	Total Price (RWF)
4	Polypropylene socket of DN ¾''	DN3/4'', PN16Bars (Used in training)	set	12	26	14	1,500.0	18,000.0
6	Polypropylene elbow of DN ¾'',90^0	DN3/4'', PN16Bars (Used in training)	set	8	26	18	1,500.0	12,000.0
12	Polyethylene union (HDPE) of DN ¾''	PN16 bars, ISO 4427	set	2	9	7	4,000.0	8,000.0
15	Polyethylene elbow(HDPE) of DN 1'', 90^0	PN16 bars, ISO 4427(Used in training)	set	2	9	7	3,500.0	7,000.0
18	Service saddle and accessories (for PVC pipes) of DN160mm-1"	Service saddle for PVC: PN16 (Used in training)	set	1	1	0	68,002.0	68,002.0
19	Service saddle and accessories (for PVC pipes) of DN160mm-3/4"	Service saddle for PVC: PN16 (Used in training)	set	1	1	0	68,003.0	68,003.0
20	Service saddle and accessories (for PVC pipes) of DN90mm-1"	Service saddle for PVC: PN16 (Used in training)	set	22	22	0	34,000.0	748,000.0
21	Service saddle and accessories (for PVC pipes) of DN90mm-3/4"	Service saddle for PVC: PN16 (Used in training)	set	2	4	2	30,000.8	60,001.5
23	Service saddle and accessories (for PVC pipes) of DN63mm-3/4"	Service saddle for PVC: PN16 (Used in training)	set	1	2	1	68,003.0	68,003.0
26	Service saddle for PEHD of DN200mm-1"	Service saddle for PEHD: PN16 (Used in Ruyenzi pilot area, Gravity pipe)	set	1	1	0	78,000.0	78,000.0
36	Ball valve of ¾''	Quarter-turn valve of ¾'' , PN16 (Used in training)	set	2	31	29	8,000.0	16,000.0
37	Ball valve of 1''	Quarter-turn valve of 1'' , PN16 (Used in training)	set	3	31	28	16,500.0	49,500.0
39	Customer water meter-15mm	ISO 4064-2005/EN14154-2007, DN15mm, L=170mm, velocity meter. Single jet dry dial, direct reading with anti-tampering sealing cup, PN16, Class C, 360° rotation register, high resistance to impurities, body in brass. (Used in meter replacement, two pilots areas)	set	15	15	0	40,038.0	600,570.0
40	Customer water meter-20mm	ISO 4064-2005/EN14154-2007, DN20mm, L=190mm, velocity meter. Single jet dry dial, direct reading with anti-tampering sealing cup, PN16, Class C, 360° rotation register, high resistance to impurities, body in brass.(Used in meter replacement, two pilots areas)	set	15	15	0	68,000.0	1,020,000.0
41	Polyethylene Pipe of DN200mm-6m	PN16 bars, ISO 4427,	set	1	1	0	315,000.0	315,000.0
42	Polyethylene Pipe of DN110mm-6m	PN16 bars, ISO 4427	set	1	1	0	280,000.0	280,000.0
44	Polyethylene Pipe of DN50mm-6m	PN16 bars, ISO 4427	set	1	1	0	27,115.0	27,115.0
50	PVC Pipe of DN63mm joined with Rubber gasket	ISO 1452, PN16 bars, ,wall thickness 4.7 mm, IPS gasket in EPDM(Used in training)	set	1	3	2	43,343.6	43,343.6
51	PVC Pipe of DN50mm joined with Rubber gasket	ISO 1452, PN16 bars, 6m, wall thickness 3.7 mm, IPS gasket in EPDM (Used in training)	set	1	1	0	27,127.8	27,127.8
56	PVC Coupling of Dn50mm	ISO 1452, PN16 bars (Used in training)	set	1	1	0	9,970.5	9,970.5
58	Galvanized Steel Pipe of DN3/4"	PN16, Class B (6m, threaded on 2 ends +1 Socket) (Used in Ruyenzi pilot area)	set	1	7	6	19,500.0	19,500.0
59	Galvanized Steel Pipe of DN1"	PN16, Class B (6m, threaded on 2 ends +1 Socket) (Used in training)	set	1	7	6	25,000.0	25,000.0
60	Galvanized Steel (Union) of DN3/4"	PN16, Class B (Used in Kadobogo pilot area)	set	22	45	23	3,500.0	77,000.0
61	Galvanized Steel (Union) of DN1"	PN16, Class B (Used in Kadobogo pilot area)	set	4	45	41	4,500.0	18,000.0
62	Galvanized Steel (Nipple) of DN3/4"	PN16, Class B (Used in training)	set	29	30	1	1,500.0	43,500.0
63	Galvanized Steel (Nipple) of DN1"	PN16, Class B (Used in training)	set	24	30	6	2,000.0	48,000.0
64	Galvanized Steel (Elbow 90°) of DN3/4"	PN16, Class B (Used in Kadobogo pilot area)	set	4	60	56	1,500.0	6,000.0
65	Galvanized Steel (Elbow 90°) of DN1"	PN16, Class B (Used in Kadobogo pilot area)	set	3	60	57	2,000.0	6,000.0
66	Galvanized Steel (Coupling for PPR-GP) of DN3/4"	PN16, Class B (Used in training)	set	9	30	21	1,500.0	13,500.0
67	Galvanized Steel (Coupling for PPR-GP) of DN1"	PN16, Class B (Used in Kadobogo pilot area)	set	3	30	27	2,000.0	6,000.0
68	Galvanized Steel (Coupling for HDPE-GP) of DN3/4"	PN16, Class B (Used in training)	set	2	30	28	1,500.0	3,000.0
75	Mechanical tool Set	Wrench set (8mm-32mm) (to be packed in a metallic box). To be supplied with at least a pair of key for each	set	1	1	0	550,000.0	550,000.0
80	Teflon tape	For water sealing (supplied in the tapes of width 25mm, thickness of 0.076-0.2mm) (Used in Kadobogo pilot area and training activities)	set	200	200	0	200.0	40,000.0

81	Customer mater with accessory	DN15mm, vane wheel type,ISO 4064-2005/EN14154-2007 (used in meter replacement in two pilot areas)	set	400	400	0	65,000.0	26,000,000.0
82	Water Flow Meter with accessory for Drinking Water	DN50mm, PN16, Mechanical Type, Flanges (installed at PM2 manhole of the pilot project)	set	1	1	0	183,600.0	183,600.0
83		DN80mm, PN16, Mechanical Type, Flanges (installed at PM1,3 manhole of the pilot project: 1set each)	set	2	2	0	233,325.0	466,650.0
84	Frange Adaptor with accessory for Drinking Water	DN50mm, PN16, for SP, Ductile Iron Body (installed at PM2 manhole of the pilot project)	set	1	1	0	225,000.0	225,000.0
85		DN80mm, PN16, for SP, Ductile Iron Body (installed at PM1,3 manhole of the pilot project: 1set each)	set	2	2	0	255,000.0	510,000.0
86	Gate Valve with accessory for Drinking Water	DN50mm, PN16, Manual (installed at PM2 manhole of the pilot project)	set	1	1	0	286,875.0	286,875.0 0.0
87		DN80mm, PN16, Manual (installed at PM1,3 manhole of the pilot project: 1set each) (installed at PM1 valve box :2sets, PM3 valve box: 1set)	set	5	5	0	240,975.0	1,204,875.0
90	Water Flow Meter with accessory for Drinking Water	DN150mm, PN16, Mechanical Type, Flanges (installed at PM4 manhole of the pilot project)	set	1	1	0	308,550.0	308,550.0
91	Frange Adaptor with accessory for Drinking Water	(Used in Kadobogo pilot area) (installed at PM4 manhole of the pilot project)	set	1	1	0	235,500.0	235,500.0
92	Gate Valve with accessory for Drinking Water	DN150mm, PN16, Manual (installed at PM4 manhole of the pilot project)	set	1	1	0	790,500.0	790,500.0
94	Analogue Pressure Gauge 25MM	IP65 protection, Range 0 to 20,000psi (installed at PM1,2,3 and 4 manhole of the pilot project: 1set each)	set	10	10	0	316,200.0	3,162,000.0
	TOTAL VALUE USED IN PILOT AREAS							37,752,686.4

Date; 28th November 2018

For WASAC

PREPARED BY:

NTAMUTURANO Desire
Head of Leak Detection and Pressure Management

VERIFIED BY:

Mr: BAHIGE Jean Berchmas
NRW Manager

APPROUVED BY:

Mr: RUTAGUNGIRA Methode
Director of Urban Water and

For JICA

ITANGISHAKA Vedaste
Assistant / Non -Revenue Water Project

Mr. SHIGEO Otani
Chief Adviser/Non-Revenue Water Management of JICA Expert Team

Equipment for Training Work on Pipe Repair and Service Pipe Connection, and Equipment for Pilot Project (Ruyenzi and Kadobogo)

In WASAC Store

PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK
Hand Over Equipment Balance list to WASAC store (Procured at Rwanda)

No.	Name of Equipment	Specification	Unit	Quantity Procured	Balance to wasac store	Unit Price (RWF)	Total Price (RWF)
1	Butte Welding Machine for Polypropylene Pipe	For Butte welding of PPR pipes and fittings w/diameters of 1" and 3/4"(to be packed in a metallic box and be supplied with an extension cable (2x2.5mm2) of 50 meters.	pce	1	1	345,000.0	345,000.0
2	Polypropylene Pipe of DN ¾''	DN3/4'', PN16Bars	m	110	120	3,150.0	378,000.0
3	Polypropylene Pipe of DN 1''	DN1'', PN16Bars	m	110	124	3,548.4	440,000.0
4	Polypropylene socket of DN ¾''	DN3/4'', PN16Bars	pce	26	14	1,500.0	21,000.0
5	Polypropylene socket of DN 1''	DN1'', PN16Bars	pce	26	26	2,000.0	52,000.0
6	Polypropylene elbow of DN ¾'',90^0	DN3/4'', PN16Bars	pce	26	18	1,500.0	27,000.0
7	Polypropylene elbow of DN 1'', 90^0	DN1'', PN16Bars	pce	26	26	2,000.0	52,000.0
8	Polyethylene Pipe(HDPE) of DN ¾''	PN16 bars, ISO 4427	roll(m)	1(100m)	1(100m)	155,363.0	155,363.0
9	Polyethylene Pipe(HDPE) of DN1''	PN16 bars, ISO 4427	roll(m)	1(100m)	1(100m)	239,840.3	239,840.3
10	Polyethylene socket (HDPE) of DN ¾''	PN16 bars, ISO 4427	pce	9	9	2,500.0	22,500.0
11	Polyethylene socket (HDPE) of DN 1''	PN16 bars, ISO 4427	pce	9	9	3,500.0	31,500.0
12	Polyethylene union (HDPE) of DN ¾''	PN16 bars, ISO 4427	pce	9	7	4,000.0	28,000.0
13	Polyethylene union (HDPE) of DN 1''	PN16 bars, ISO 4427	pce	9	9	4,500.0	40,500.0
14	Polyethylene elbow (HDPE) of DN ¾'' , 90^0	PN16 bars, ISO 4427	pce	9	9	2,500.0	22,500.0
15	Polyethylene elbow(HDPE) of DN 1'', 90^0	PN16 bars, ISO 4427	pce	9	9	3,500.0	31,500.0
16	Service saddle and accessories (for PVC pipes) of DN200mm-1"	Service saddle for PVC: PN16	pce	1	1	68,000.0	68,000.0
17	Service saddle and accessories (for PVC pipes) of DN200mm-3/4"	Service saddle for PVC: PN16	pce	1	1	68,001.0	68,001.0
21	Service saddle and accessories (for PVC pipes) of DN90mm-3/4"	Service saddle for PVC: PN16	pce	4	2	30,000.8	60,001.5
22	Service saddle and accessories (for PVC pipes) of DN63mm-1"	Service saddle for PVC: PN16	pce	2	2	21,160.8	42,321.5
23	Service saddle and accessories (for PVC pipes) of DN63mm-3/4"	Service saddle for PVC: PN16	pce	2	1	68,003.0	68,003.0
24	Service saddle and accessories (for PVC pipes) of DN50mm-1"	Service saddle for PVC: PN16	pce	1	1	34,000.0	34,000.0
25	Service saddle and accessories (for PVC pipes) of DN50mm-3/4"	Service saddle for PVC: PN16	pce	1	1	32,000.0	32,000.0
27	Service saddle for PEHD of DN200mm-3/4"	Service saddle for PEHD: PN16	pce	1	1	75,000.0	75,000.0
28	Service saddle for PEHD of DN110mm-1"	Service saddle for PEHD: PN16	pce	1	1	70,000.0	70,000.0
29	Service saddle for PEHD of DN110mm-3/4"	Service saddle for PEHD: PN16	pce	1	1	68,000.0	68,000.0
30	Service saddle for PEHD of DN63mm-1"	Service saddle for PEHD: PN16	pce	21	21	21,160.8	444,375.8
31	Service saddle for PEHD of DN63mm-3/4"	Service saddle for PEHD: PN16	pce	3	3	30,000.8	90,002.3
32	Service saddle for PEHD of DN50mm-1"	Service saddle for PEHD: PN16	pce	1	1	29,973.1	29,973.1
33	Service saddle for PEHD of DN50mm-3/4"	Service saddle for PEHD: PN16	pce	1	1	21,160.8	21,160.8

34	Service saddle for PEHD of DN40mm-1"	Service saddle for PEHD: PN16	pce	1	1	21,160.8	21,160.8
35	Service saddle for PEHD of DN40mm-3/4"	Service saddle for PEHD: PN16	pce	1	1	21,160.8	21,160.8
36	Ball valve of ¾''	Quarter-turn valve of ¾'' , PN16	pce	31	29	8,000.0	232,000.0
37	Ball valve of 1''	Quarter-turn valve of 1'' , PN16	pce	31	28	16,500.0	462,000.0
38	Butte Welding Machine for Polyethylene Pipe	For Butte welding of PEHD pipes and fittings w/diameters of 50mm to 200mm	pce	1	1	250,000.0	250,000.0
43	Polyethylene Pipe of DN63mm-6m	PN16 bars, ISO 4427	m	18	18	21,675.0	390,150.0
45	Polyethylene Pipe of DN40mm-6m	PN16 bars, ISO 4427	m	6	6	4,166.7	25,000.0
46	Polyethylene end cup of DN63mm	PN16 bars, ISO 4427	pce	4	4	24,531.0	98,124.0
47	PVC Pipe of DN200mm joined with Rubber gasket	ISO 1452, PN16 bars, 6m, wall thickness 14.9 mm, IPS gasket in EPDM	pce	1	1	354,195.0	354,195.0
48	PVC Pipe of DN160mm joined with Rubber gasket	ISO 1452, PN16 bars, 6m, wall thickness 11.9 mm, IPS gasket in EPDM	pce	1	1	226,607.9	226,607.9
49	PVC Pipe of DN90mm joined with Rubber gasket	ISO 1452, PN16 bars, 6m, wall thickness 6.7 mm, IPS gasket in EPDM	pce	4	4	87,902.8	351,611.0
50	PVC Pipe of DN63mm joined with Rubber gasket	ISO 1452, PN16 bars, ,wall thickness 4.7 mm, IPS gasket in EPDM	pce	3	2	43,343.6	86,687.3
52	PVC (Coupling) of DN200mm	ISO 1452, PN16 bars	pce	1	1	224,516.9	224,516.9
53	PVC Coupling of DN160mm	ISO 1452, PN16 bars	pce	1	1	99,777.3	99,777.3
54	PVC Coupling of DN90mm	ISO 1452, PN16 bars	pce	2	2	32,440.3	64,880.5
55	PVC Coupling of DN63mm	ISO 1452, PN16 bars	pce	1	1	14,955.8	14,955.8
57	PVC End Cap DN90mm	ISO 1452, PN16 bars	pce	4	4	11,262.5	45,050.0
58	Galvanized Steel Pipe of DN3/4"	PN16, Class B (6m, threaded on 2 ends +1 Socket)	pce	7	6	19,500.0	117,000.0
59	Galvanized Steel Pipe of DN1"	PN16, Class B (6m, threaded on 2 ends +1 Socket)	pce	7	6	25,000.0	150,000.0
60	Galvanized Steel (Union) of DN3/4"	PN16, Class B	pce	45	23	3,500.0	80,500.0
61	Galvanized Steel (Union) of DN1"	PN16, Class B	pce	45	41	4,500.0	184,500.0
62	Galvanized Steel (Nipple) of DN3/4"	PN16, Class B	pce	30	1	1,500.0	1,500.0
63	Galvanized Steel (Nipple) of DN1"	PN16, Class B	pce	30	6	2,000.0	12,000.0
64	Galvanized Steel (Elbow 90°) of DN3/4"	PN16, Class B	pce	60	56	1,500.0	84,000.0
65	Galvanized Steel (Elbow 90°) of DN1"	PN16, Class B	pce	60	57	2,000.0	114,000.0
66	Galvanized Steel (Coupling for PPR-GP) of DN3/4"	PN16, Class B	pce	30	21	1,500.0	31,500.0
67	Galvanized Steel (Coupling for PPR-GP) of DN1"	PN16, Class B	pce	30	27	2,000.0	54,000.0
68	Galvanized Steel (Coupling for HDPE-GP) of DN3/4"	PN16, Class B	pce	30	28	1,500.0	42,000.0
69	Galvanized Steel (Coupling for HDPE-GP) of DN1"	PN16, Class B	pce	30	30	2,000.0	60,000.0

70	Drilling machine for water pipes of 25-160mm	Manual under pressure drilling machine appropriate for PVC pipe, polyethylene pipes tool box which contains necessary parts and accessories to drill pipes of DN from 25 to 160mm. To be supplied with at least a pair of toll for each diameter.	pce	1	1	5,500,000.0	5,500,000.0
71	Strap Wrench	Crotch type wrench up to dia. 300mm	pce	1	1	1,750,000.0	1,750,000.0
72	Plastic Pipe Cutter	Set of tools for DN25 -315mm Pipes (to be packed in a metallic box). To be supplied with at least a pair of toll for each diameter.	pce	1	1	3,500,000.0	3,500,000.0
73	Steel Pipe Cutter	Set of tools for DN 1/2"- 4" (to be packed in a metallic box). To be supplied with at least a pair of toll for each diameter.	pce	1	1	3,500,000.0	3,500,000.0
74	Pipe Threader	Set of tools for DN 3/4"-2" (to be packed in a metallic box). To be supplied with at least a pair of toll for each diameter.	pce	1	1	300,000.0	300,000.0
76	Manual Pressure Testing Pump	Testing and pressure range: 0-60 bar, Tank capacity: not less than 10L	pce	1	1	850,000.0	850,000.0
77	Generator	Silent type , Portable, 4kva, 220-240V	pce	1	1	4,500,000.0	4,500,000.0
78	Generator	Silent type , Portable, 6.5kva, 220-240V	pce	1	1	5,500,000.0	5,500,000.0
79	Pipe Jack Stand	Suitable for DN 3/4 to 50 mm pipe	pce	1	1	150,000.0	150,000.0
88	companion flanges	DN50mm, PN16, SP	pce	3	3	87,000.0	261,000.0
89	companion flanges	DN90mm, PN16, SP	pce	6	6	112,000.0	672,000.0
93	Companion flanges	DN150mm, PN16, SP	pce	3	3	157,000.0	471,000.0
	TOTAL VALUE OF BALANCE TO WASAC STORE						**33,910,419.1**

Date; 27th November 2018

For WASAC Central store

MUKABACONDO Placidie
Store keeper

NYIRABEZA Marie Jeanne

LOGISTICS OFFICER

WATER AND SANITATION CORPORATION * WASAC * MAGASIN CENTRAL EAU

For JICA

ITANGISHAKA Vedaste
Assistant NRW Project

27/11/2018

Mr. SHIGEO Otani
Chief Adviser/Non-Revenue Water Management of JICA Expert Team

Pipes and Related Fittings for Service Pipe Replacement in Kadobogo

PRICE QUOTATION ON PROCUREMENT OF PIPE AND ITS ACCESSORY
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL
IN KIGALI CITY WATER NETWORK

Addressed to Kyowa Engineering Consultants Co., Ltd.

PRICE QUOTATION FOR PIPE REPLACEMENT IN KADOBOGO

Part 1. PM1 (Sub-zone 1-3)

N°	DESCRIPTION	UNIT	Qty	Unit price (Frw)	Total price (Frw)
I	**Supply pipes of;**				
1	PVC (Ganga type) pipes ND32 NP 16	Pcs	14	16 500	231 000
2	PVC (Ganga type) pipes ND25 NP 16	Pcs	19	13 000	247 000
	Sub -Total				**478 000**
II	**ACCESSORIES AND FITTINGS**				
1	Screwed clamp for pvc 63*1" NP 16 (type DI)	Pcs	3	15 000	45 000
2	Nipple 1" galvanized NP 16	Pcs	6	1 500	9 000
3	Nipple 3/4" galvanized NP 16	Pcs	16	1 500	24 000
4	Union 1" galvanized NP 16	Pcs	9	2 500	22 500
5	Union 3/4" galvanized NP 16	Pcs	6	2 000	12 000
6	Galvanized reducer 1" * 3/4"	Pcs	4	3 000	12 000
7	ball valve 1" NP 16	Pcs	6	10 000	60 000
8	ball valve 3/4" NP 16	Pcs	8	7 000	56 000
9	Galvanized Tee 1" NP 16	Pcs	3	2 000	6 000
10	Galvanized Tee 3/4" NP 16	Pcs	2	1 000	2 000
11	Galvanized elbow (90°) 1" NP 16	Pcs	4	2 000	8 000
12	Galvanized elbow (90°) 3/4" NP 16	Pcs	7	1 000	7 000
13	Galvanized Socket 1" NP 16	Pcs	16	2 000	32 000
14	Galvanized Socket 3/4" NP 16	Pcs	15	1 000	15 000
15	Teflon	Pcs	25	500	12 500
	Sub -Total				323 000
	Total(I+II)				**801 000**

Part 2. PM1 (Sub-zone 1-4)

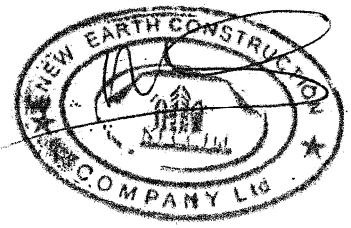
N°	DESCRIPTION	UNIT	Qty	Unit price (Frw)	Total price (Frw)
I	**Supply pipes of;**				
1	PVC (Ganga type) pipes ND32 NP 16	Pcs	65	16 500	1 072 500
2	PVC (Ganga type) pipes ND25 NP 16	Pcs	41	13 000	533 000
	Sub -Total				**1 605 500**
II	**ACCESSORIES AND FITTINGS**				
1	Screwed clamp for pvc 63*1" NP 16 (type DI)	Pcs	6	15 000	90 000
2	Screwed clamp for pvc 63*3/4" NP 16 (type DI)	Pcs	4	15 000	60 000
3	Nipple 1" galvanized NP 16	Pcs	21	1 500	31 500
4	Nipple 3/4" galvanized NP 16	Pcs	42	1 500	63 000
5	Union 1" galvanized NP 16	Pcs	25	2 500	62 500
6	Union 3/4" galvanized NP 16	Pcs	29	1 800	52 200
7	Galvanized reducer 1" * 3/4"	Pcs	25	2 500	62 500
8	Galvanized end cup 3/4" NP 16	Pcs	8	1 000	8 000
9	ball valve 1" NP 16	Pcs	9	10 000	90 000
10	ball valve 3/4" NP 16	Pcs	32	6 800	217 600
11	Galvanized Tee 1" NP 16	Pcs	23	2 000	46 000
12	Galvanized Tee 3/4" NP 16	Pcs	2	1 000	2 000
13	Galvanized elbow (90°) 1" NP 16	Pcs	2	2 000	4 000
14	Galvanized elbow (90°) 3/4" NP 16	Pcs	12	1 000	12 000
15	Galvanized Socket 1" NP 16	Pcs	67	1 900	127 300
16	Galvanized Socket 3/4" NP 16	Pcs	35	1 000	35 000
17	Teflon	Pcs	80	500	40 000
	Sub -Total				1 003 600
	Total (I+II)				**2 609 100**

GRAND TOTAL

	GRAND TOTAL(Part1+Part2)		801000	2609100	**3 410 100**

the total amount is three milion four hundred ten thousand and hundred rwandan francs (3410100 rw) hAll Tax Inclusive

done at kigali, on 11th december 2018
new earth construction ltd
mukamwiza pascaline



PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK

INSPECTION RECORD OF PROCUREMENT THE PIPES AND ACCESSORIES FOR REPLACEMENT IN KADOBOGO PILOT AREA

Contract Price: 3,410,100.00 (Frw)

Contraction period: 14th December 2018 to 25th January 2019

Name of Contractor: NEW EARTH CONSTRUCTION COMPANY LTD

Delivery Date: 19 th December 2018

Final inspection Date: 19 th December 2018

Part 1. PM1 (Sub-zone 1-3)

N°	DESCRIPTION	UNIT	Qty	Observations
I	Supply pipes of;			
1	PVC (Ganga type) pipes ND32 NP 16	Pcs	14	Received
2	PVC (Ganga type) pipes ND25 NP 16	Pcs	19	Received
	Sub -Total			
II	ACCESSORIES AND FITTINGS			
1	Screwed clamp for pvc 63*1" NP 16 (type DI)	Pcs	3	Received
2	Nipple 1" galvanized NP 16	Pcs	6	Received
3	Nipple 3/4" galvanized NP 16	Pcs	16	Received
4	Union 1" galvanized NP 16	Pcs	9	Received
5	Union 3/4" galvanized NP 16	Pcs	6	Received
6	Galvanized reducer 1" * 3/4"	Pcs	4	Received
7	ball valve 1" NP 16	Pcs	6	Received
8	ball valve 3/4" NP 16	Pcs	8	Received
9	Galvanized Tee 1" NP 16	Pcs	3	Received
10	Galvanized Tee 3/4" NP 16	Pcs	2	Received
11	Galvanized elbow (90°) 1" NP 16	Pcs	4	Received
12	Galvanized elbow (90°) 3/4" NP 16	Pcs	7	Received
13	Galvanized Socket 1" NP 16	Pcs	16	Received
14	Galvanized Socket 3/4" NP 16	Pcs	15	Received
15	Teflon	Pcs	25	Received

Part 2. PM1 (Sub-zone 1-4)

N°	DESCRIPTION	UNIT	Qty	Observations
I	Supply pipes of;			
1	PVC (Ganga type) pipes ND32 NP 16	Pcs	65	Received
2	PVC (Ganga type) pipes ND25 NP 16	Pcs	41	Received
	Sub -Total			
II	ACCESSORIES AND FITTINGS			
1	Screwed clamp for pvc 63*1" NP 16 (type DI)	Pcs	6	Received
2	Screwed clamp for pvc 63*3/4" NP 16 (type DI)	Pcs	4	Received
3	Nipple 1" galvanized NP 16	Pcs	21	Received
4	Nipple 3/4" galvanized NP 16	Pcs	42	Received
5	Union 1" galvanized NP 16	Pcs	25	Received
6	Union 3/4" galvanized NP 16	Pcs	29	Received
7	Galvanized reducer 1" * 3/4"	Pcs	25	Received
8	Galvanized end cup 3/4" NP 16	Pcs	8	Received
9	ball valve 1" NP 16	Pcs	9	Received
10	ball valve 3/4" NP 16	Pcs	32	Received
11	Galvanized Tee 1" NP 16	Pcs	23	Received
12	Galvanized Tee 3/4" NP 16	Pcs	2	Received
13	Galvanized elbow (90°) 1" NP 16	Pcs	2	Received
14	Galvanized elbow (90°) 3/4" NP 16	Pcs	12	Received
15	Galvanized Socket 1" NP 16	Pcs	67	Received
16	Galvanized Socket 3/4" NP 16	Pcs	35	Received
17	Teflon	Pcs	80	Received

Member of Inspection **Date:** 19/12/2018

A. WASAC MEMBER

Names	Position	Signature
RUTEMBESA J.M.V	Leak Detection & Pressure Mgt Operator	19/12/2018
NDAYAMBAZA Marie	Accountant	20/12/2018
MUSABYEYEZU Jeanne	Branch Manager	19/12/2018

B. JICA MEMBER

Names	Position	Signature
Vedaste ITANGISHAKA	Assistant NRW project/waste-JICA	
Toru Toyoda	JICA Expert	

C. CONTRACTOR

Names	Position	Signature
MUKAMUYIZA Pascaline	Managing Director	

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Kigali -Rwanda
TIN:102542892
MUSEZERO CELL
GISOZI SECTOR

PRICE QUOTATION ON PROCUREMENT OF PIPE AND ITS ACCESSORY
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL
IN KIGALI CITY WATER NETWORK

Addressed to Kyowa Engineering Consultants Co., Ltd.

ADDITIONAL PROCUREMENT TO THE ORIGINAL CONTRACT ON DECEMBER 14, 2018. (ITEM 1)

PRICE QUOTATION FOR PIPE REPLACEMENT IN KADOBOGO

N°	DESCRIPTION	UNIT	Qty1	Unit price (Frw)	Total price 1 (Frw)
II	ACCESSORIES AND FITTINGS				
3	Nipple 3/4" galvanized NP 16	Pcs	6	1,500	9,000
5	Union 3/4" galvanized NP 16	Pcs	8	2,000	16,000
15	Teflon	Pcs	45	500	22,500
	Sub -Total				**47,500**

Done at Kigali, on February 15, 2019

New Earth Construction Company
MUKAMWIZA Pascaline
Managing Director

INSPECTION RECORD OF PROCUREMENT THE PIPES AND ACCESSORIES FOR REPLACEMENT IN KADOBOGO PILOT AREA

Contract Price: 47,500.00 (Frw)

Name of Contractor: NEW EARTH CONSTRUCTION COMPANY LTD

Delivery Date: 24 th February 2019

Final inspection Date: 24 th February 2019

LIST OF THE MATERIALS PROCURED FOR THE PIPE REPLACEMENT IN KADOBOGO PILOT AREA IN THE PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK

N°	DESCRIPTION ITEM 1	UNIT	Qty1	Comments
II	**ACCESSORIES AND FITTINGS**			
1	Nipple 3/4" galvanized NP 16	Pcs	6	Received
2	Union 3/4" galvanized NP 16	Pcs	8	Received
3	Teflons	Pcs	45	Received
	Sub -Total			
	All Tax Inclusive with reduction			

A. WASAC MEMBER **DATE:** 24/02/2019

Names	Position	Signature
DUSABE claire	WASAC Branch Technician operator	
Musabyeyezu Jeanne	Head of Branch	

B. JICA MEMBER

Names	Position	Signature
Vedaste ITANGISHAKA	Assistant NRW project	
K. 大 [illegible] OTANI	Expert JICA	Otani

C. CONTRACTOR

Names	Position	Signature
Mukamusoni Parcaline	Managing director	

NEW EARTH CONSTRUCTION COMPANY LTD
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Kigali -Rwanda
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MUSEZERO CELL
GISOZI SECTOR

PRICE QUOTATION ON PROCUREMENT OF PIPE AND ITS ACCESSORY
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL
IN KIGALI CITY WATER NETWORK

Addressed to Kyowa Engineering Consultants Co., Ltd.

ADDITIONAL PROCUREMENT TO THE ORIGINAL CONTRACT ON DECEMBER 14, 2018. (ITEM 2)

PRICE QUOTATION FOR PIPE REPLACEMENT IN KADOBOGO

Part 1. PM1 (Sub-zone 1-3)

N°	DESCRIPTION	UNIT	Qty1	Qty 2	Unit price (Frw)	Total price 1 (Frw)	Total price 2 (Frw)
I	Supply pipes of;						
1	PPR (Ganga type) pipes ND32 NP 2.0	Pcs	14	0	16,500	231,000	0
2	PPR (Ganga type) pipes ND25 NP 2.5	Pcs	19	0	13,000	247,000	0
	Sub-Total					**478,000**	**0**
II	ACCESSORIES AND FITTINGS						
1	Screwed clamp for pvc 63*1" NP 16 (type DI)	Pcs	3	0	15,000	45,000	0
2	Nipple 1" galvanized NP 16	Pcs	6	0	1,500	9,000	0
3	Nipple 3/4" galvanized NP 16	Pcs	16	15	1,500	24,000	22500
4	Union 1" galvanized NP 16	Pcs	9	10	2,500	22,500	25000
5	Union 3/4" galvanized NP 16	Pcs	6	15	2,000	12,000	30000
6	Galvanized reducer 1" * 3/4"	Pcs	4	5	3,000	12,000	15000
7	ball valve 1" NP 16	Pcs	6	0	10,000	60,000	0
8	ball valve 3/4" NP 16	Pcs	8	0	7,000	56,000	0
9	Galvanized Tee 1" NP 16	Pcs	3	0	2,000	6,000	0
10	Galvanized Tee 3/4" NP 16	Pcs	2	0	1,000	2,000	0
11	Galvanized elbow (90°) 1" NP 16	Pcs	4	0	2,000	8,000	0
12	Galvanized elbow (90°) 3/4" NP 16	Pcs	7	0	1,000	7,000	0
13	Galvanized Socket 1" NP 16	Pcs	16	0	2,000	32,000	0
14	Galvanized Socket 3/4" NP 16	Pcs	15	0	1,000	15,000	0
15	Teflon	Pcs	25	50	500	12,500	25000
	Sub-Total					**323,000**	**117,500**
	Total(I+II)					**801,000**	**117,500**

Part 2. PM1 (Sub-zone 1-4)							
N°	DESCRIPTION	UNIT	Qty		Unit price (Frw)	Total price (Frw)	
I	Supply pipes of;						
1	PPR (Ganga type) pipes ND32 NP 2.0	Pcs	65	15	16,500	1,072,500	247500
2	PPR (Ganga type) pipes ND25 NP 2.5	Pcs	41	0	13,000	533,000	0
	Sub-Total					1,605,500	247500
II	ACCESSORIES AND FITTINGS						
1	Screwed clamp for pvc 63*1" NP 16 (type DI)	Pcs	6	0	15,000	90,000	0
2	Screwed clamp for pvc 63*3/4" NP 16 (type DI)	Pcs	4	0	15,000	60,000	0
3	Nipple 1" galvanized NP 16	Pcs	21	0	1,500	31,500	0
4	Nipple 3/4" galvanized NP 16	Pcs	42	35	1,500	63,000	52500
5	Union 1" galvanized NP 16	Pcs	25	10	2,500	62,500	25000
6	Union 3/4" galvanized NP 16	Pcs	29	25	1,800	52,200	45000
7	Galvanized reducer 1" * 3/4"	Pcs	25	10	2,500	62,500	25000
8	Galvanized end cup 3/4" NP 16	Pcs	8	0	1,000	8,000	0
9	ball valve 1" NP 16	Pcs	9	0	10,000	90,000	0
10	ball valve 3/4" NP 16	Pcs	32	0	6,800	217,600	0
11	Galvanized Tee 1" NP 16	Pcs	23	0	2,000	46,000	0
12	Galvanized Tee 3/4" NP 16	Pcs	2	0	1,000	2,000	0
13	Galvanized elbow (90°) 1" NP 16	Pcs	2	0	2,000	4,000	0
14	Galvanized elbow (90°) 3/4" NP 16	Pcs	12	0	1,000	12,000	0
15	Galvanized Socket 1" NP 16	Pcs	67	0	1,900	127,300	0
16	Galvanized Socket 3/4" NP 16	Pcs	35	0	1,000	35,000	0
17	Teflon	Pcs	80	80	500	40,000	40000
	Sub-Total					1,003,600	187500
	Total (I+II)					2,609,100	435000
GRAND TOTAL							
	GRAND TOTAL(Part1+Part2)					3,410,100	552,500
	All Tax Inclusive with reduction						

Done at Kigali, on February 21, 2019

New Earth Construction Company
MUKAMWIZA Pascaline
Managing Director

PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK

INSPECTION RECORD OF PROCUREMENT THE PIPES AND ACCESSORIES FOR REPLACEMENT IN KADOBOGO PILOT AREA

Contract Price: 552,500.00 (Frw)

Name of Contractor: NEW EARTH CONSTRUCTION COMPANY LTD

Delivery Date: 24 th February 2019

Final inspection Date: 24 th February 2019

Additional procurement to the Original contract on December 14, 2018. (ITEM 2)

Part 1. PM1 (Sub-zone 1-3)

N°	DESCRIPTION	UNIT	Qty 2
I	**Supply pipes of;**		
1	PPR (Ganga type) pipes ND32 NP 2.0	Pcs	0
2	PPR (Ganga type) pipes ND25 NP 2.5	Pcs	0
	Sub -Total		
II	**ACCESSORIES AND FITTINGS**		
1	Screwed clamp for pvc 63*1" NP 16 (type DI)	Pcs	
2	Nipple 1" galvanized NP 16	Pcs	0
3	Nipple 3/4" galvanized NP 16	Pcs	15
4	Union 1" galvanized NP 16	Pcs	10
5	Union 3/4" galvanized NP 16	Pcs	15
6	Galvanized reducer 1" * 3/4"	Pcs	5
7	ball valve 1" NP 16	Pcs	0
8	ball valve 3/4" NP 16	Pcs	0
9	Galvanized Tee 1" NP 16	Pcs	0
10	Galvanized Tee 3/4" NP 16	Pcs	0
11	Galvanized elbow (90°) 1" NP 16	Pcs	0
12	Galvanized elbow (90°) 3/4" NP 16	Pcs	0
13	Galvanized Socket 1" NP 16	Pcs	0
14	Galvanized Socket 3/4" NP 16	Pcs	0
15	Teflon	Pcs	50

Part 2. PM1 (Sub-zone 1-4)

N°	DESCRIPTION	UNIT	
I	**Supply pipes of;**		
1	PPR (Ganga type) pipes ND32 NP 2.0	Pcs	15
2	PPR (Ganga type) pipes ND25 NP 2.5	Pcs	0
	Sub -Total		
II	**ACCESSORIES AND FITTINGS**		
1	Screwed clamp for pvc 63*1" NP 16 (type DI)	Pcs	0
2	Screwed clamp for pvc 63*3/4" NP 16 (type DI)	Pcs	0
3	Nipple 1" galvanized NP 16	Pcs	0
4	Nipple 3/4" galvanized NP 16	Pcs	35
5	Union 1" galvanized NP 16	Pcs	10
6	Union 3/4" galvanized NP 16	Pcs	25
7	Galvanized reducer 1" * 3/4"	Pcs	10
8	Galvanized end cup 3/4" NP 16	Pcs	0
9	ball valve 1" NP 16	Pcs	0
10	ball valve 3/4" NP 16	Pcs	0
11	Galvanized Tee 1" NP 16	Pcs	0
12	Galvanized Tee 3/4" NP 16	Pcs	0
13	Galvanized elbow (90°) 1" NP 16	Pcs	0
14	Galvanized elbow (90°) 3/4" NP 16	Pcs	0
15	Galvanized Socket 1" NP 16	Pcs	0
16	Galvanized Socket 3/4" NP 16	Pcs	0
17	Teflon	Pcs	80

Member of Inspection

Date: 24/02/2019

A. WASAC MEMBER

Names	Position	Signature
NDAYAMBAJE Alexis	Accountant	
MUSABYEYEZU Jeanne	Head of Branch Kayonza	

B. JICA MEMBER

Names	Position	Signature
Vedaste ITANGISHAKA	Assistant NRW project/WASAC-JICA	
Shigeo OTANI	JICA Expert	

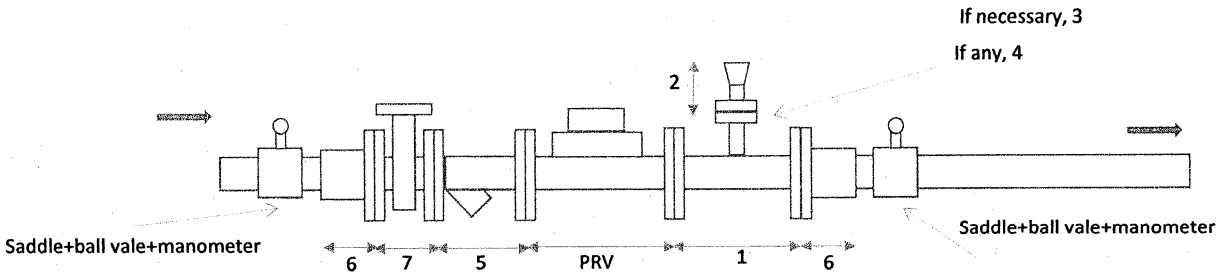
C. CONTRACTOR

Names	Position	Signature
MUKANWIZA Pascaline	Managing director	

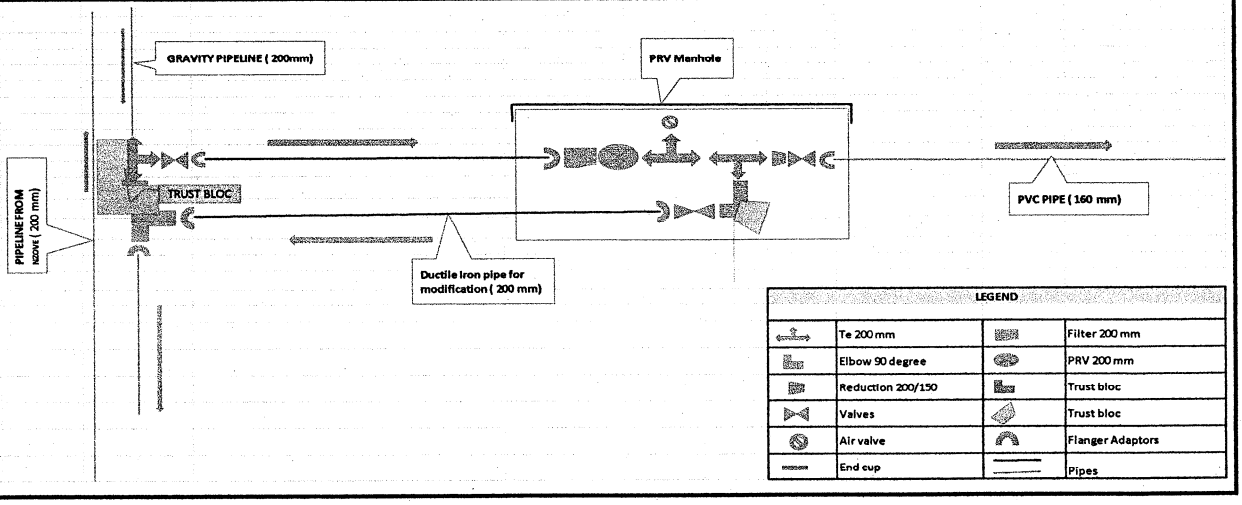
PRV Fittings in Pilot Area (Ruyenzi and Kadobogo)

BOQ							
To:	THE PROJECT FOR STRANGHNING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK						
Price list of PRV accessories for Ruyenzi Pilot Area 2							
No	Item	Diameter	Specification	Quantity	Unit Price RWF	Total RWF	Stock in WASAC
for 200mm							
MATERIALS AVAILABLE IN WASAC FOR PRVs (Ruyenzi 200 mm PVC pipe *2)							
1	Flanged Reducer	φ200 x φ25 or 40	PN16, SP, Gasket, Bolt and Nut	1		-	Yes
2	Ball valve	1/2"	PN16, metal body, Gasket, Bolt and Nut	2		-	Yes
3	Ball valve	1"	PN16, metal body, Gasket, Bolt and Nut	1		-	No
4	Flange Adapter	φ200	PN16, SP, Gasket, Bolt and Nut, Ductile body	4		-	Yes
5	PRV	φ200	PN16, Metal Body	2		-	Yes
6	Saddle	φ200xφ50	PN16, Metal or PVC body w/Gasket, Bolt and Nut	6		-	Yes
7	Pressure Gage	1/2"	0-25bar, (if 1/4" with 1/2"Socket)	4		-	Yes
8	Attachment for Air Valve	-	Nipple1"	2 set		-	Yes
9	Attachment for Pressure Gage	-	Bussing(1-3/4"), Nipple(3/4"),	4 sets		-	Yes
10	Bolt nuts M20*70	-	-	200		-	Yes
11	Valve DN 150	φ150	PN16, Metal Body	1		-	Yes
12	Valve DN 200	φ200	PN16, Metal Body	1		-	Yes
13	Reducer DN 200/150	φ200/150	PN16, Metal Body	1		-	Yes
14	Flanger adaptors for PVC DN 150	φ150	PN16, Metal Body	1		-	Yes
15	Ductile iron pipe DN 200	φ200	PN16, Metal Body	4		-	Yes
16	Flanger adaptors for DUCTILE IRON DN 200	φ200	PN16, Metal Body	4		-	Yes

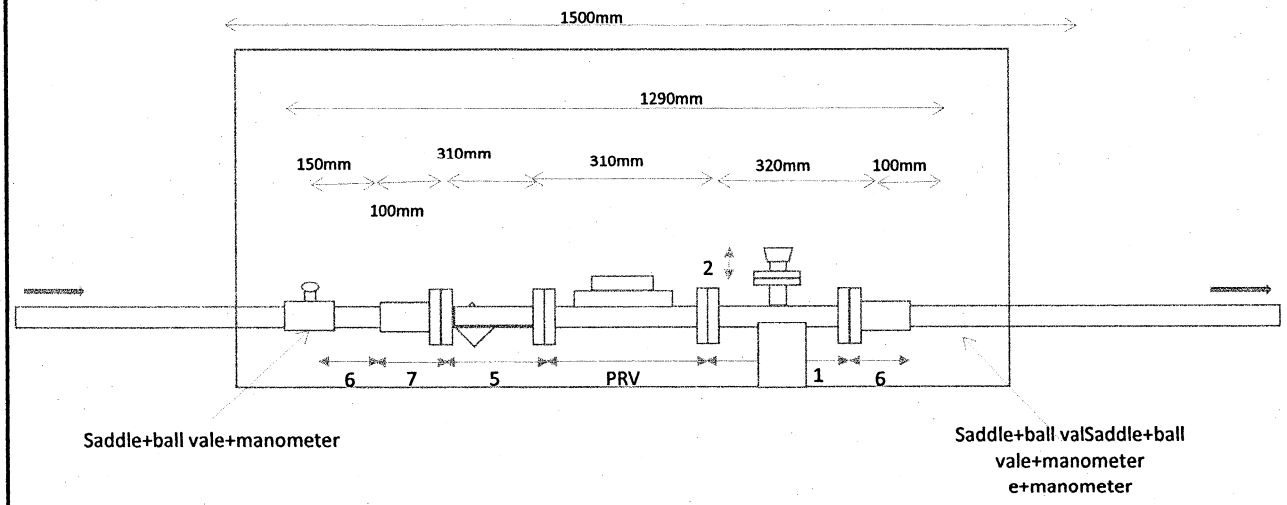
MATERIALS AND VALUE PAID BY JICA FOR PRVs (200 mm PVC Pipe* 2)							
17	All Flanged TEE	φ200×φ50	PN16, Gasket, Bolt and Nut, Ductile body	2	230,000	460,000	No
18	Flanged High Speed Air Release Valve	φ25	PN16, metal body, Gasket, Bolt and Nut	2	80,000	160,000	No
19	Quick Flanger adopter for PVC 200 mm	φ200	PN16, metal body, Gasket, Bolt and Nut	2	90,000	180,000	No
20	Teflons			4	250	1,000	No
21	Strainer for PRV	φ200	PN16,Dactile body, Gasket, Bolt and Nut	2	250,000	500,000	NO
22	Gate Valve	φ200	PN16, SP, Gasket, Bolt and Nut, Ductile body	2	280,000	560,000	No
40	Te equal DN 200	φ200	PN16, Metal Body	1	200,000	200,000	No
41	Flanger adaptor for PVC DN 200	φ200	PN16, Metal Body	1	95000	95,000	No
42	Elbows 90 egree DN 200	φ200	PN16, Metal Body	2	150000	300,000	No
43	Dismontling joint DN 200 PN 16	φ200	PN16, Metal Body	1	240000	240,000	No
TOTAL PAID FOR INSTALLATION OF PRV AT RUYENZI 200 MM (By pass and Gravity) AND PM 3 KADOBOGO PILOTS AREAS						**2,696,000**	



MODIFICATION FOR PRV INSTALLATION ON GRAVITY PIPELINE (200 mm) - KAMUHANDA



Price list of PRV accessories for PM3 (Kadobogo Pilot Area 1)							
No	Item	Diameter	Specification	Quantity	Unit Price RWF	Total RWF	Stock in WASAC
MATERIALS AND VALUE FOR PRV AT KAGUGU PM 3 (90 mm PVC)							
1	All Flanged TEE	φ80×φ25 or 40	PN16, SP, Gasket, Bolt and Nut, Dactile body	1	80,000	80,000	No
2	Flanged High Speed Air Release Valve	φ25	PN16, metal body, Gasket, Bolt and Nut	1	80,000	80,000	No
3	Flanger adopter for PVC 90 mm	φ 90	PN16, metal body, Gasket, Bolt and Nut	2	45,000	90,000	No
TOTAL PAID BY JICA							**250,000**
MATERIALS AVAILABLE IN WASAC STORE FOR PRV AT KADOBOGO PM 3 (90 mm PVC)							
4	Ball valve	1/2"	PN16, metal body, Gasket, Bolt and Nut	1		-	Yes
5	Strainer for PRV	φ80	PN16,Dactile body, Gasket, Bolt and Nut	1		-	Yes
6	Flange Adapter	φ80	PN16, SP, Gasket, Bolt and Nut, Dactile body	2		-	Yes
7	PRV	φ80	PN16, Metal Body	1		-	Yes
8	Pressure Gage	1/2" or 1/4"	0-25bar, (if 1/4" with 1/2"Socket)	2		-	Yes
9	Attachment for Air Vlave	-	Nipple1"	1 set		-	Yes
10	Attachment for Pressure Gage	-	Bussing(1-3/4"), Nipple(3/4"), Joint (3/4male-	2 sets		-	Yes



BIZIMANA

Dealers in: General Hard Wares and Industrial Plumbing Fitting
(Flanges, Valves, Bends, Tees, PVC Pressure Pipes and Fittings)
Tel: +250 788502901 / +250 788580414
KIGALI - RWANDA

R.C.A 298
T.V.A 101381967

M/s: _____

NO	843
DATE	

INVOICE

QTY	DESCRIPTION	RATE	AMOUNT
1	All Flange Tee Ø80 Ø25 PN16 (Complet)	80.000	80 000
2	All Flange Tee Ø100 x 50 PN16 (Complet)	230 000	460 000
3	Air valves Ø25 PN 16	80 000	240 000
2	Strainers for PRV DN 200 PN16	250 000	500 000
2	Gat valve DN 200 PN16	280 000	560 000
	Paid 1,840,000		
	Cash		
E. & O.E		TOTAL	1,840,000

BIZIMANA COME
TIN: 101381967
TEL: 0788502801

Amount in words: .....

.....

Sign: .....

For: AQUATECNIC

BIZIMANA

Dealers in: General Hard Wares and Industrial Plumbing Fitting
(Flanges, Valves, Bends, Tees, PVC Pressure Pipes and Fittings)
Tel: +250 788502901 / +250 788580414
KIGALI - RWANDA

R.C.A 298
T.V.A 101381967

M/s: Kigali Engineering Consultants Co. Ltd

NO	559
DATE	17.9.2018

INVOICE

QTY	DESCRIPTION	RATE	AMOUNT
2	Flanges adapter for PVC 90mm	45,000	90,000
2	Flanges adapter for PVC 225mm	90,000	180,000
4	Teflons	250	1,000
	271,000 Frw cash		
E. & O.E		TOTAL	271,000

Amount in words: .....

.....

Sign: .....

For: AQUATECNIC

BIZIMANA

Dealers in: General Hard Wares and Industrial Plumbing Fitting
(Flanges, Valves, Bends, Tees, PVC Pressure Pipes and Fittings)
Tel: +250 788502901 / +250 788580414
KIGALI - RWANDA

R.C.A 298
T.V.A 101381967

M/s: KYOWA ENGINEERING CONSULTANTS Co.Ltd.

NO	864
DATE	16.10.2018

INVOICE

QTY	DESCRIPTION	RATE	AMOUNT
1	Flanges adaptor / PVC DN200 PN16	95,000	95,000
1	Té equal with all Flangers DN200	200,000	200,000
E. & O.E		TOTAL	295,000

95,000

Amount in words: .....

.....

Sign: .....

BIZIMANA COMS
TIN:101381967
TEL: 07...
For: AQUATECNIC

BIZIMANA

Dealers in: General Hard Wares and Industrial Plumbing Fitting
(Flanges, Valves, Bends, Tees, PVC Pressure Pipes and Fittings)
Tel: +250 788502901 / +250 788580414
KIGALI - RWANDA

R.C.A 298
T.V.A 101381967

M/s: KYOWA ENGINEERING CONSULTANTS Co. Ltd.

NO	865
DATE	18.10.2018

INVOICE

QTY	DESCRIPTION	RATE	AMOUNT
2	Elbows 90 DEGREE / DN200 PN16	150,000	300,000
1	Dismontling Joint DN200 PN16	240,000	240,000
E. & O.E		TOTAL	540,000

540,000

Amount in words: .....

.....

Sign: .....

BIZIMANA COMZ
For: AQUATECNIC

BOQ

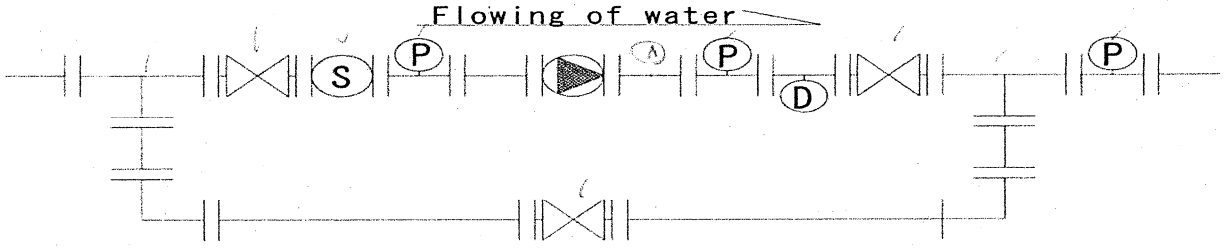
Price list of PRV accessories for DN43mm (Ruyenzi Pilot Area 2)

No	Item	Diameter	Specification	Quantity	Unit Price RWF	Total RWF	Stock in WASAC
			For 40mm				
1	Te with reduction AG	1 1/4"/ 1"	PN16, Galvanised	1	8,000	8,000	No
2	Te with reduction AG	1"/1/2"	PN16, Galvanised	1	5,000	5,000	No
3	Ball valve AG	1/2"	PN16,Galvanised	1	10,000	10,000	No
4	Ball valve AG	1"	PN16,Galvanised	1	5,000	5,000	No
5	Nipples AG	1 1/4"	PN16,Galvanised	4	7,500	30,000	No
	Nipples AG	1"	PN16,Galvanised	3	1,000	3,000	No
6	Unions AG	1 1/4"	PN16,Galvanised	4	4,500	18,000	No
7	PRV AG	1 1/4"	PN16,Galvanised	1	75,000	75,000	No
8	Coupling Adopter	DN 80	PN16, Metal body	2	3,500	7,000	No
9	Elbow	φ40	PVC PN 16	2	45,000	90,000	No
10	Glue AG	-		1./2	5,000	5,000	No
	Teflons			8	200	1,600	No
11	Reduction AG	1/2"/ 1/8"	PN16,Galvanised	2	3,500	7,000	No
	TOTAL PAID BY JICA					264,600	

			Materials available in WASAC				
	Saddles	φ40*1"	PVC PN 16	4	-	-	Yes
	Valve	1 1/4"	PN16,Galvanised	1	-	-	Yes
	Filter	1 1/4"	PN16,Galvanised	1	-	-	Yes
	Pressure gauge	25 bars	PN16,Galvanised	3	-	-	Yes
	Adaptor nipples	φ40*1"	PVC PN 16	4	-	-	Yes

For 40 mm isntallation Drawing

For example PRV Installing



S ストレーナー
P 水圧計
D ドレーン

Le 13.6.2011

Kyowa Engineering

Consultants: Co. Ltd.

960,000 Tsh

AG Te	1	Te with reduction 1½/½"	5000	5000
AG Te	1	Te with reduction 1"/½"	5000	5000
AG	1	Ball valve 1"	8000	8000
AG	1	Ball valve ½"	5000	5000
AG	4	Unions Galvanized	7500	30000
AG	4	Nipples galvanized	4500	18000
AG	1	PRV (pressure reduction) ½"	7500	7500
PVC	2	Elbow PN16	3500	7000
Metal	2	Coupling PN16	45000	90,000
	1½	Glue ½ kg	8000	8000
AG	2	Reduction 2"/1"	3500	7000

960,000 Tsh

960,000 Tsh

QUINCAILLERIE GIFT

TIN : 103127897 Date: 24/9/2018

TEL: 0788753752/0728753752

Runda-Ruyenzi

FACTURE N°: 1290

M. NOVA ENGINEERING Company

Qté	Désignation	P.Unit	P.Total
3	Mupke 11	1000	3000
	3000		

- *Les marchandises vendues ne peuvent pas être reprises*
- *Icyaguzwe ntikigaruka mu iduka.*

TOTAL 3000

QUINCAILLERIE GIFT

TIN : 103127897 Date: 24/9/2018

TEL: 0788753752/0728753752

Runda-Ruyenzi

FACTURE N°: 1288

M. NOVA ENGINEERING Company

Qté	Désignation	P.Unit	P.Total
8	Tuyau	200	1600
	1600		

- *Les marchandises vendues ne peuvent pas être reprises*
- *Icyaguzwe ntikigaruka mu iduka.*

TOTAL 1600

WASAC
Water & Sanitation Corporation

"Dignifying Life"

Kigali, 21 MAY 2020 **No 11.07.024/1295/20/DUWSS - CEO/dn**

To: Mr. MARUO Shin
Chief Representative Office
JICA RWANDA Office

Dear sir,

Re: Receipt of Equipment from JICA

We are pleased to inform you that we have received the equipment herewith attached from JICA in the project for "Strengthening Non-Revenue WATER Control in Kigali City Water Network" based on the Record of Discussions signed on March 30, 2016 between WASAC and JICA.

The received equipment is for:

- On-site Portable Test Water Meter(26 sets)

We should take responsibility of the security, care and maintenance of equipment and keep them in good condition.

In addition, we would like to utilize them effectively even after the project.

Sincerely,

WATER & SANITATION CORPORATION WASAC CHIEF EXECUTIVE OFFICER

Eng. Aimé MUZOLA
Chief Executive Officer
Water and Sanitation Corporation Limited (WASAC Ltd)

Attachment:
- List of Equipment

CC:
-Director of Urban Water and Sanitation Services, WASAC Ltd
-Director of Support Services, WASAC Ltd

SERIES NUMBER FOR PORTABLE TEST METERS FROM JICA	
1	89094251
2	89072338
3	89083661
4	89094228
5	89094229
6	89094230
7	89094231
8	89094232
9	89094233
10	89094234
11	89094235
12	89094236
13	89094237
14	89094240
15	89094241
16	89094246
17	89094247
18	89094248
19	89094249
20	89094252
21	89094253
22	89094254
23	89094255
24	89094257
25	89094258
26	89094259

Inspection Record

Procurement Work of Pressure Reducing Pipes and Fittings for
the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

Date: 25th February, 2020

No	Item	DN	Specification	Contract Quantity	Inspection Quantity	Remark
1	Potable Test Meter	DN 15	ELSTER Potable Testing Station DN15,based on the Y290 water meter	26	26	The reception of the products (Portable test meter) are received, base on the good results and the certicate from the RSB labotory.

Member of Inspection

WASAC

NAME	POSITION	SIGNATURE
Jérôme NTAMUNDARO	Head of Leak detection & pressure unit	25/02/2020
Felicien Niringiyimana	Head of Meter MS	25/02/2020

JICA

NAME	POSITION	SIGNATURE
Vedaste ITANGISHAKA	Assistant NRW project WASAC - JICA	
Masanobu MAYUSUMI	JICA expert	2/11

SUPPLYER

NAME	POSITION	SIGNATURE
Rwamagasu K. Aniceti	Clearing Agent	

Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY
VERIFICATION CERTIFICATE N°: 233/6B/2019-2020

1.0 Customer's Details

Name of Customer/ Industry	: Vedaste ITANGISHAKA
Location	: Kigali
Tel	: 0788655645/0788537229
E-mail	: -

2.0 Details of the Instrument

Name of the instrument	: Water meter
Manufacturer	: HONEYWELL
Model	: H; PN 16
Serial N°	: 89094236
Identification Number	: -
Calibration range/ Capacity	: DN15; Q3=3m^3/h
Interval (e)/ Accuracy	: -
Condition of the Instrument	: Good
Sticker Number	: FEB20C0448
Calibration Date	: 17/02/2020

3.0 Standard(s) used to calibrate the Instrument (s)

Standard Name	Model	Serial number	Sticker number	Calibration Date
Testing Bench	EP-40; U<0.1%	S/N: 0032	B-030/00308	02/2019

This verification certificate documents the traceability to national standards, which realize the units of measurement according to the international system of units (SI).

4.0 Procedure Used to calibrate the Instrument (s)

RBS/MU/6B/OP-01: Calibration Procedure for water meters intended for the metering of cold potable water.
ISO 4064:3 (2005): Measurement of water flow in fully charged closed conduits-Meters for cold potable water and hot water —Part 3: Test methods and equipment.

5.0 Remark

As agreed with the customer, the calibration due date is not later than **02/2020**

Flow rate (m^3/h)	Error (%)	MPE (%)	Conclusion
Q3: 2	-0.42	± 2	The Error is within Allowable Error Limits
Q2: 0.05	-0.38	± 2	The Error is within Allowable Error Limits
Q1: 0.03	1.22	± 5	The Error is within Allowable Error Limits

for
Eric M. KARAMUZI
Director of Mechanical and Electrical Laboratories Unit
Signature.....Date: 20./02/..2020

Mr. Philibert ZIMULINDA
Division Manager
For
Director General
Signature.....Date: 20/02/2020

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Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY

VERIFICATION CERTIFICATE N°: 233/6B/2019-2020

6.0 Environmental Conditions

Air Temperature		Air Pressure		Relative Humidity	
Readings	Correction	Readings	Correction	Readings	Correction
22.5 °C	0.04 °C	848.0 mbar	0.70 mbar	54.9 %	-0.1 %

7.0 Results

Flowrate Q3: 2 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
2.00	3	251.626	23.10	2.43	141.85	139.42	139.90	-0.34	2
2.00	3	251.945	23.00	3.54	143.03	139.49	140.20	-0.51	2
						PASS	**Em2**	**-0.42**	**2**
							Em3		**2**

Flowrate Q2: 0.048 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.05	2	600.423	23.10	0.09	8.14	8.05	8.08	-0.37	2
0.05	2	614.612	23.20	0.06	8.30	8.24	8.27	-0.39	2
						PASS	**Em2**	**-0.38**	**2**
							Em3		**2**

Flowrate Q1: 0.03 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.03	2	1000.461	23.00	0.32	8.94	8.62	8.51	1.28	5
0.03	2	1000.425	23.10	0.00	8.63	8.63	8.53	1.15	5
						PASS	**Em2**	**1.22**	**5**
							Em3		**5**

Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY
VERIFICATION CERTIFICATE N°: 232/6B/2019-2020

1.0 Customer's Details

Name of Customer/ Industry	: Vedaste ITANGISHAKA
Location	: Kigali
Tel	: 0788655645/0788537229
E-mail	: -

2.0 Details of the Instrument

Name of the instrument	: Water meter
Manufacturer	: HONEYWELL
Model	: H; PN 16
Serial N°	: 89094237
Identification Number	: -
Calibration range/ Capacity	: DN15; Q3=3m^3/h
Interval (e)/ Accuracy	: -
Condition of the Instrument	: Good
Sticker Number	: FEB20C0447
Calibration Date	: 17/02/2020

3.0 Standard(s) used to calibrate the Instrument (s)

Standard Name	Model	Serial number	Sticker number	Calibration Date
Testing Bench	EP-40; U<0.1%	S/N: 0032	B-030/00308	02/2019

This verification certificate documents the traceability to national standards, which realize the units of measurement according to the international system of units (SI).

4.0 Procedure Used to calibrate the Instrument (s)

RBS/MU/6B/OP-01: Calibration Procedure for water meters intended for the metering of cold potable water.
ISO 4064:3 (2005): Measurement of water flow in fully charged closed conduits-Meters for cold potable water and hot water —Part 3: Test methods and equipment.

5.0 Remark

As agreed with the customer, the calibration due date is not later than **02/2020**

Flow rate (m^3/h)	Error (%)	MPE (%)	Conclusion
Q3: 2	-0.65	± 2	The Error is within Allowable Error Limits
Q2: 0.05	-0.14	± 2	The Error is within Allowable Error Limits
Q1: 0.03	0.86	± 5	The Error is within Allowable Error Limits

for **Eric M. KARAMUZI**
Director of Mechanical and Electrical Laboratories Unit
Signature......**Date**20../02./2020

Mr. Philibert ZIMULINDA
Division Manager
For
Director General
Signature......**Date**20/02/2020

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Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY

VERIFICATION CERTIFICATE N°: 232/6B/2019-2020

6.0 Environmental Conditions

Air Temperature		Air Pressure		Relative Humidity	
Readings	Correction	Readings	Correction	Readings	Correction
22.5 °C	0.04 °C	848.0 mbar	0.70 mbar	54.9 %	-0.1 %

7.0 Results

Flowrate Q3: 2 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
2.00	3	251.626	23.10	2.43	141.51	139.08	139.90	-0.58	2
2.00	3	251.945	23.00	3.54	142.75	139.21	140.20	-0.71	2
						PASS	**Em2**	**-0.65**	**2**
							Em3		**2**

Flowrate Q2: 0.048 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.05	2	600.423	23.10	0.09	8.16	8.07	8.08	-0.13	2
0.05	2	614.612	23.20	0.06	8.32	8.26	8.27	-0.14	2
						PASS	**Em2**	**-0.65**	**2**
							Em3		**2**

Flowrate Q1: 0.03 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.03	2	1000.461	23.00	0.32	8.90	8.58	8.51	0.81	5
0.03	2	1000.425	23.10	0.00	8.61	8.61	8.53	0.91	5
						PASS	**Em2**	**0.86**	**5**
							Em3		**5**

Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY
VERIFICATION CERTIFICATE N°: 231/6B/2019-2020

1.0 Customer's Details

Name of Customer/ Industry	: Vedaste ITANGISHAKA
Location	: Kigali
Tel	: 0788655645/0788537229
E-mail	: -

2.0 Details of the Instrument

Name of the instrument	: Water meter
Manufacturer	: HONEYWELL
Model	: H; PN 16
Serial N°	: 89094240
Identification Number	: -
Calibration range/ Capacity	: DN15; Q3=3m^3/h
Interval (e)/ Accuracy	: -
Condition of the Instrument	: Good
Sticker Number	: FEB20C0446
Calibration Date	: 17/02/2020

3.0 Standard(s) used to calibrate the Instrument (s)

Standard Name	Model	Serial number	Sticker number	Calibration Date
Testing Bench	EP-40; U<0.1%	S/N: 0032	B-030/00308	02/2019

This verification certificate documents the traceability to national standards, which realize the units of measurement according to the international system of units (SI).

4.0 Procedure Used to calibrate the Instrument (s)

RBS/MU/6B/OP-01: Calibration Procedure for water meters intended for the metering of cold potable water.
ISO 4064:3 (2005): Measurement of water flow in fully charged closed conduits-Meters for cold potable water and hot water —Part 3: Test methods and equipment.

5.0 Remark

As agreed with the customer, the calibration due date is not later than **02/2020**

Flow rate (m^3/h)	Error (%)	MPE (%)	Conclusion
Q3: 2	-0.35	± 2	The Error is within Allowable Error Limits
Q2: 0.05	-0.32	± 2	The Error is within Allowable Error Limits
Q1: 0.03	-0.75	± 5	The Error is within Allowable Error Limits

for **Eric M. KARAMUZI**
Director of Mechanical and Electrical Laboratories Unit
Signature: ..... Date: 20/02/2020

Mr. Philibert ZIMULINDA
Division Manager
For
Director General
Signature: ..... Date: 20/02/2020

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Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY
VERIFICATION CERTIFICATE N°: 231/6B/2019-2020

6.0 Environmental Conditions

Air Temperature		Air Pressure		Relative Humidity	
Readings	Correction	Readings	Correction	Readings	Correction
22.5 °C	0.04 °C	848.0 mbar	0.70 mbar	54.9 %	-0.1 %

7.0 Results

Flowrate Q3: 2 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
2.00	3	251.626	23.10	2.43	141.96	139.53	139.90	-0.26	2
2.00	3	251.945	23.00	3.54	143.14	139.60	140.20	-0.43	2
						PASS	**Em2**	**-0.35**	**2**
							Em3		**2**

Flowrate Q2: 0.048 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.05	2	600.423	23.10	0.09	8.14	8.05	8.08	-0.37	2
0.05	2	614.612	23.20	0.06	8.31	8.25	8.27	-0.26	2
						PASS	**Em2**	**-0.32**	**2**
							Em3		**2**

Flowrate Q1: 0.03 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.03	2	1000.461	23.00	0.32	8.88	8.56	8.51	0.58	5
0.03	2	1000.425	23.10	0.00	8.61	8.61	8.53	0.91	5
						PASS	**Em2**	**0.75**	**5**
							Em3		**5**

Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY
VERIFICATION CERTIFICATE N°: 230/6B/2019-2020

1.0 Customer's Details

Name of Customer/ Industry	: Vedaste ITANGISHAKA
Location	: Kigali
Tel	: 0788655645/0788537229
E-mail	: -

2.0 Details of the Instrument

Name of the instrument	: Water meter
Manufacturer	: HONEYWELL
Model	: H; PN 16
Serial N°	: 89094233
Identification Number	: -
Calibration range/ Capacity	: DN15; Q3=3m^3/h
Interval (e)/ Accuracy	: -
Condition of the Instrument	: Good
Sticker Number	: FEB20C0445
Calibration Date	: 17/02/2020

3.0 Standard(s) used to calibrate the Instrument (s)

Standard Name	Model	Serial number	Sticker number	Calibration Date
Testing Bench	EP-40; U<0.1%	S/N: 0032	B-030/00308	02/2019

This verification certificate documents the traceability to national standards, which realize the units of measurement according to the international system of units (SI).

4.0 Procedure Used to calibrate the Instrument (s)

RBS/MU/6B/OP-01: Calibration Procedure for water meters intended for the metering of cold potable water.
ISO 4064:3 (2005): Measurement of water flow in fully charged closed conduits-Meters for cold potable water and hot water —Part 3: Test methods and equipment.

5.0 Remark

As agreed with the customer, the calibration due date is not later than **02/2020**

Flow rate (m^3/h)	Error (%)	MPE (%)	Conclusion
Q3: 2	-0.92	± 2	The Error is within Allowable Error Limits
Q2: 0.05	0.54	± 2	The Error is within Allowable Error Limits
Q1: 0.03	0.69	± 5	The Error is within Allowable Error Limits

for **Eric M. KARAMUZI**
Director of Mechanical and Electrical Laboratories Unit
Signature..... **Date** 20.02.2020

Mr. Philibert ZIMULINDA
Division Manager
For
Director General
Signature..... **Date** 20.02.2020

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Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY

VERIFICATION CERTIFICATE N°: 230/6B/2019-2020

6.0 Environmental Conditions

Air Temperature		Air Pressure		Relative Humidity	
Readings	Correction	Readings	Correction	Readings	Correction
22.5 °C	0.04 °C	848.0 mbar	0.70 mbar	54.9 %	-0.1 %

7.0 Results

Flowrate Q3: 2 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
2.00	3	251.626	23.10	2.43	141.18	138.75	139.90	-0.82	2
2.00	3	251.945	23.00	3.54	142.32	138.78	140.20	-1.01	2
						PASS	**Em2**	**-0.92**	**2**
							Em3		**2**

Flowrate Q2: 0.048 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.05	2	600.423	23.10	0.09	8.22	8.13	8.08	0.62	2
0.05	2	614.612	23.20	0.06	8.37	8.31	8.27	0.46	2
						PASS	**Em2**	**0.54**	**2**
							Em3		**2**

Flowrate Q1: 0.03 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.03	2	1000.461	23.00	0.32	8.89	8.57	8.51	0.70	5
0.03	2	1000.425	23.10	0.00	8.59	8.59	8.53	0.68	5
						PASS	**Em2**	**0.69**	**5**
							Em3		**5**

Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY
VERIFICATION CERTIFICATE N°: 229/6B/2019-2020

1.0 Customer's Details

Name of Customer/ Industry	: Vedaste ITANGISHAKA
Location	: Kigali
Tel	: 0788655645/0788537229
E-mail	: -

2.0 Details of the Instrument

Name of the instrument	: Water meter
Manufacturer	: HONEYWELL
Model	: H; PN 16
Serial N°	: 89072338
Identification Number	: -
Calibration range/ Capacity	: DN15; Q3=3m^3/h
Interval (e)/ Accuracy	: -
Condition of the Instrument	: Good
Sticker Number	: FEB20C0444
Calibration Date	: 17/02/2020

3.0 Standard(s) used to calibrate the Instrument (s)

Standard Name	Model	Serial number	Sticker number	Calibration Date
Testing Bench	EP-40; U<0.1%	S/N: 0032	B-030/00308	02/2019

This verification certificate documents the traceability to national standards, which realize the units of measurement according to the international system of units (SI).

4.0 Procedure Used to calibrate the Instrument (s)

RBS/MU/6B/OP-01: Calibration Procedure for water meters intended for the metering of cold potable water.
ISO 4064:3 (2005): Measurement of water flow in fully charged closed conduits-Meters for cold potable water and hot water —Part 3: Test methods and equipment.

5.0 Remark

As agreed with the customer, the calibration due date is not later than **02/2020**

Flow rate (m^3/h)	Error (%)	MPE (%)	Conclusion
Q3: 2	-1.24	± 2	The Error is within Allowable Error Limits
Q2: 0.05	-0.32	± 2	The Error is within Allowable Error Limits
Q1: 0.03	0.22	± 5	The Error is within Allowable Error Limits

fos **Eric M. KARAMUZI**
Director of Mechanical and Electrical Laboratories Unit
Signature..... **Date:** 20/02/2020

Mr. Philibert ZIMULINDA
Division Manager
For
Director General
Signature..... **Date:** 20/02/2020

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Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY

VERIFICATION CERTIFICATE N°: 229/6B/2019-2020

6.0 Environmental Conditions

Air Temperature		Air Pressure		Relative Humidity	
Readings	Correction	Readings	Correction	Readings	Correction
22.5 °C	0.04 °C	848.0 mbar	0.70 mbar	54.9 %	-0.1 %

7.0 Results

Flowrate Q3: 2 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
2.00	3	251.626	23.10	2.43	140.69	138.26	139.90	-1.17	2
2.00	3	251.945	23.00	3.54	141.90	138.36	140.20	-1.31	2
						PASS	**Em2**	**-1.24**	**2**
							Em3		**2**

Flowrate Q2: 0.048 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.05	2	600.423	23.10	0.09	8.14	8.05	8.08	-0.37	2
0.05	2	614.612	23.20	0.06	8.31	8.25	8.27	-0.26	2
						PASS	**Em2**	**-0.32**	**2**
							Em3		**2**

Flowrate Q1: 0.03 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.03	2	1000.461	23.00	0.32	8.84	8.52	8.51	0.11	5
0.03	2	1000.425	23.10	0.00	8.56	8.56	8.53	0.33	5
						PASS	**Em2**	**0.22**	**5**
							Em3		**5**

Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY

VERIFICATION CERTIFICATE N°: 228/6B/2019-2020

1.0 Customer's Details

Name of Customer/ Industry	: Vedaste ITANGISHAKA
Location	: Kigali
Tel	: 0788655645/0788537229
E-mail	: -

2.0 Details of the Instrument

Name of the instrument	: Water meter
Manufacturer	: HONEYWELL
Model	: H; PN 16
Serial N°	: 89094251
Identification Number	: -
Calibration range/ Capacity	: DN15; Q3=3m^3/h
Interval (e)/ Accuracy	: -
Condition of the Instrument	: Good
Sticker Number	: FEB20C0443
Calibration Date	: 17/02/2020

3.0 Standard(s) used to calibrate the Instrument (s)

Standard Name	Model	Serial number	Sticker number	Calibration Date
Testing Bench	EP-40; U<0.1%	S/N: 0032	B-030/00308	02/2019

This verification certificate documents the traceability to national standards, which realize the units of measurement according to the international system of units (SI).

4.0 Procedure Used to calibrate the Instrument (s)

RBS/MU/6B/OP-01: Calibration Procedure for water meters intended for the metering of cold potable water.
ISO 4064:3 (2005): Measurement of water flow in fully charged closed conduits-Meters for cold potable water and hot water —Part 3: Test methods and equipment.

5.0 Remark

As agreed with the customer, the calibration due date is not later than **02/2020**

Flow rate (m^3/h)	Error (%)	MPE (%)	Conclusion
Q3: 2	-0.95	± 2	The Error is within Allowable Error Limits
Q2: 0.05	-0.14	± 2	The Error is within Allowable Error Limits
Q1: 0.03	0.75	± 5	The Error is within Allowable Error Limits

Eric M. KARAMUZI
Director of Mechanical and Electrical Laboratories Unit
Signature: ..... **Date:** 20./02./2020

Mr. Philibert ZIMULINDA
Division Manager
For
Director General
Signature: ..... **Date:** 20./02./2020

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Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY

VERIFICATION CERTIFICATE N°: 228/6B/2019-2020

6.0 Environmental Conditions

Air Temperature		Air Pressure		Relative Humidity	
Readings	Correction	Readings	Correction	Readings	Correction
22.5 °C	0.04 °C	848.0 mbar	0.70 mbar	54.9 %	-0.1 %

7.0 Results

Flowrate Q3: 2 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
2.00	3	251.626	23.10	2.43	141.17	138.74	139.90	-0.83	2
2.00	3	251.945	23.00	3.54	142.24	138.70	140.20	-1.07	2
						PASS	**Em2**	**-0.95**	**2**
							Em3		**2**

Flowrate Q2: 0.048 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.05	2	600.423	23.10	0.09	8.15	8.06	8.08	-0.25	2
0.05	2	614.612	23.20	0.06	8.33	8.27	8.27	-0.02	2
						PASS	**Em2**	**-0.14**	**2**
							Em3		**2**

Flowrate Q1: 0.03 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.03	2	1000.461	23.00	0.32	8.88	8.56	8.51	0.58	5
0.03	2	1000,425	23.10	0.00	8.61	8.61	8.53	0.91	5
						PASS	**Em2**	**0.75**	**5**
							Em3		**5**

Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY
VERIFICATION CERTIFICATE N°: 227/6B/2019-2020

1.0 Customer's Details

Name of Customer/ Industry	: Vedaste ITANGISHAKA
Location	: Kigali
Tel	: 0788655645/0788537229
E-mail	: -

2.0 Details of the Instrument

Name of the instrument	: Water meter
Manufacturer	: HONEYWELL
Model	: H; PN 16
Serial N°	: 89094228
Identification Number	: -
Calibration range/ Capacity	: DN15; Q3=3m^3/h
Interval (e)/ Accuracy	: -
Condition of the Instrument	: Good
Sticker Number	: FEB20C0442
Calibration Date	: 17/02/2020

3.0 Standard(s) used to calibrate the Instrument (s)

Standard Name	Model	Serial number	Sticker number	Calibration Date
Testing Bench	EP-40; U<0.1%	S/N: 0032	B-030/00308	02/2019

This verification certificate documents the traceability to national standards, which realize the units of measurement according to the international system of units (SI).

4.0 Procedure Used to calibrate the Instrument (s)

RBS/MU/6B/OP-01: Calibration Procedure for water meters intended for the metering of cold potable water.
ISO 4064:3 (2005): Measurement of water flow in fully charged closed conduits-Meters for cold potable water and hot water —Part 3: Test methods and equipment.

5.0 Remark

As agreed with the customer, the calibration due date is not later than **02/2020**

Flow rate (m^3/h)	Error (%)	MPE (%)	Conclusion
Q3: 2	-1.12	± 2	The Error is within Allowable Error Limits
Q2: 0.05	-0.20	± 2	The Error is within Allowable Error Limits
Q1: 0.03	0.04	± 5	The Error is within Allowable Error Limits

for **Eric M. KARAMUZI**
Director of Mechanical and Electrical Laboratories Unit
Signature: ..... Date: 20/02/2020

Mr. Philibert ZIMULINDA
Division Manager
For
Director General
Signature: ..... Date: 20/02/2020

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Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY

VERIFICATION CERTIFICATE N°: 227/6B/2019-2020

6.0 Environmental Conditions

Air Temperature		Air Pressure		Relative Humidity	
Readings	Correction	Readings	Correction	Readings	Correction
22.5 °C	0.04 °C	848.0 mbar	0.70 mbar	54.9 %	-0.1 %

7.0 Results

Flowrate Q3: 2 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
2.00	3	251.626	23.10	2.43	140.88	138.45	139.90	-1.03	2
2.00	3	251.945	23.00	3.54	142.04	138.50	140.20	-1.21	2
						PASS	**Em2**	**-1.12**	**2**
							Em3		**2**

Flowrate Q2: 0.048 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.05	2	600.423	23.10	0.09	8.15	8.06	8.08	-0.25	2
0.05	2	614.612	23.20	0.06	8.32	8.26	8.27	-0.14	2
						PASS	**Em2**	**-0.20**	**2**
							Em3		**2**

Flowrate Q1: 0.03 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.03	2	1000.461	23.00	0.32	8.83	8.51	8.51	-0.01	5
0.03	2	1000.425	23.10	0.00	8.54	8.54	8.53	0.09	5
						PASS	**Em2**	**0.04**	**5**
							Em3		**5**

Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY
VERIFICATION CERTIFICATE N°: 226/6B/2019-2020

1.0 Customer's Details

Name of Customer/ Industry	: Vedaste ITANGISHAKA
Location	: Kigali
Tel	: 0788655645/0788537229
E-mail	: -

2.0 Details of the Instrument

Name of the instrument	: Water meter
Manufacturer	: HONEYWELL
Model	: H; PN 16
Serial N°	: 89094258
Identification Number	: -
Calibration range/ Capacity	: DN15; Q3=3m³/h
Interval (e)/ Accuracy	: -
Condition of the Instrument	: Good
Sticker Number	: FEB20C0441
Calibration Date	: 17/02/2020

3.0 Standard(s) used to calibrate the Instrument (s)

Standard Name	Model	Serial number	Sticker number	Calibration Date
Testing Bench	FP-40; U<0.1%	S/N: 0032	B-030/00308	02/2019

This verification certificate documents the traceability to national standards, which realize the units of measurement according to the international system of units (SI).

4.0 Procedure Used to calibrate the Instrument (s)

RBS/MU/6B/OP-01: Calibration Procedure for water meters intended for the metering of cold potable water.
ISO 4064:3 (2005): Measurement of water flow in fully charged closed conduits-Meters for cold potable water and hot water —Part 3: Test methods and equipment.

5.0 Remark

As agreed with the customer, the calibration due date is not later than **02/2020**

Flow rate (m³/h)	Error (%)	MPE (%)	Conclusion
Q3: 2	-0.73	± 2	The Error is within Allowable Error Limits
Q2: 0.05	0.35	± 2	The Error is within Allowable Error Limits
Q1: 0.03	1.10	± 5	The Error is within Allowable Error Limits

for **Eric M. KARAMUZI**
Director of Mechanical and Electrical Laboratories Unit
Signature... Date: 20/02/2020

Mr. Philibert ZIMULINDA
Division Manager
For
Director General
Signature... Date: 20/02/2020

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Rwanda Standards Board

NATIONAL METROLOGY DIVISION

FLOW LABORATORY

VERIFICATION CERTIFICATE N°: 226/6B/2019-2020

6.0 Environmental Conditions

Air Temperature		Air Pressure		Relative Humidity	
Readings	Correction	Readings	Correction	Readings	Correction
22.5 °C	0.04 °C	848.0 mbar	0.70 mbar	54.9 %	-0.1 %

7.0 Results

Flowrate Q3: 2 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
2.00	3	251.626	23.10	2.43	141.46	139.03	139.90	-0.62	2
2.00	3	251.945	23.00	3.54	142.56	139.02	140.20	-0.84	2
						PASS	**Em2**	**0.17**	**2**
							Em3		**2**

Flowrate Q2: 0.048 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.05	2	600.423	23.10	0.09	8.20	8.11	8.08	0.37	2
0.05	2	614.612	23.20	0.06	8.36	8.30	8.27	0.34	2
						PASS	**Em2**	**0.35**	**2**
							Em3		**2**

Flowrate Q1: 0.03 (m3/h)	Supply Pressure (bar)	Testing Time (s)	Water Temp (oC)	Initial Readings (L)	Final Readings (L)	Indicated Volume (L)	Actual Volume (L)	Meter Error (Em) (%)	MPE (1) (%)
0.03	2	1000.461	23.00	0.32	8.94	8.62	8.51	1.28	5
0.03	2	1000.425	23.10	0.00	8.61	8.61	8.53	0.91	5
						PASS	**Em2**	**1.10**	**5**
							Em3		**5**

Portable testing station for special applications

DN 15

Based on the Y290 water meter

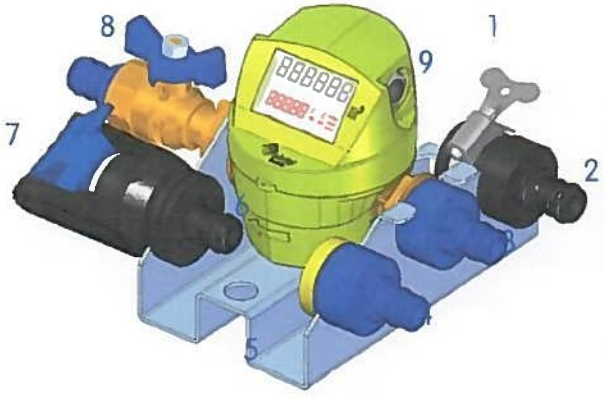
Y290 water meter is part of the single jet Elster Iberconta's Product Portfolio. This type of water meters are hybrids because they combine a mechanical sensor with an electronic register. This combination provide a high accuracy and easy to collect information from the meter. The electronic register module is compound for two color high contrast LCD with digits 10 mm height. 6 black digits in the LCD top part are for cubic meters and additional information as flow rate, etc and 5 red digits in the LCD bottom part are for decimals of cubic meters. LCD in the bottom part gives others relevant information of flow direction, error flags for magnetic manipulation or battery status.

Benefits

The portable water meter testing station gives saving from costly dismantling and handling operations to move the meter to be tested to fix test bench. Water meter which fault suspected is tested "in situ" in its own installation site to know whether it is or not within the limits of required accuracy values.

Components

1. Tap adapter.
2. Gasket G1".
3. Inlet Fitting.
4. Adpater 3/4" y 1/2".
5. Support base.
6. Gasket 3/4".
7. Monoblock adapter.
8. Outlet fitting.
9. Button.



Main Features

- Electronic, high accuracy meter.
- High contrast LCD with 10mm height digits for read easiness and information icons.
- Flexible hosepipes and adapters to allow connection to any kind of valve or tap.
- An anodized aluminium base to higher protection level.
- All these installed in a light, small size plastic case, with adjustable strap for convenience transport.
- For water up to 40°C.
- With estimated battery autonomy 12 years.

Register

Warranty:
Meters are warranted for one year from any manufacturing default in his operation and/or materials from the date of delivery. This warranty must be understood as the replacement of the piece or pieces in our workshops. The warranty does not cover damage caused by improper installation, incorrect handing, force majeure, or whether the data provided does not fit the actual conditions of work. By the same, it would be excluded from the security breakdown or failure by the freezing of the fluid is in its interior and the consequent increase in the volume of it. For everything not included in this summary, it must be applied the condition of security, that is available under the terms of Elster.

Technical data

Measuring range	l/h	30 -3.000
Accuracy	%	0,5
Minimum display resolution	liters	0,01
Maximum working press	bar	16
Maximum working temperature	ºC	40
Length	mm.	275
Height	mm.	155
Width	mm.	225
Weight (aprox.)	kg.	2,75

How to use

Connect the test station to the valve or tap that feeds water meter to be checked using the suitable coupling/hose contained into the suitcase. Purge air bubbles passing water flow, make sure that all circuit is full of water and close the exit valve. Then reset the display and take the read of the test meter. Open the exit valve to pass water flow and close when essay is finish and compare the reading of installed water meter with the recorded read of the test station. Then calculate the error of measurement by difference proportionality.

The test meter included into the station, has a button located in its right side; this can be operated within three ways: short press (normal), long press (with auto repeat every 1 second if held) and release after long press.

- In a working status, a short press freezes the value displayed on the screen. Another short press releases this freeze and value showed is updated.

- By long press, we can access to four possible reading status in the LCD: flow rate, partial volume passed, reset of partial volume and cumulative volume passed (not resettable). Releasing the button sets the screen status showed on the display.

Parameters stored into the memory

The following parameters are recorded into meter's memory:

- Log in the session with month, day, hour and minute.
- Log out the session with hour and minute.
- Total volumen recorded during whole session.

Access to these data is by means of a reading software connecting meter communications port (RJ connector integrated in it) to hand held or a computer using communication interface).

elster
Iberconta

Elster Medición, S.A.U.

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www.elster-iberconta.com

Catálogo Ref.: EIENPNAR111151

WASAC
Water & Sanitation Corporation

"Dignifying Life"

Kigali,.....26 NOV 2020.....
No 11.07.024/2813/2020/DUWSS/dn

To: Mr. MARUO Shin
Chief Representative
JICA Rwanda Office

RE: Receipt of Equipment from JICA

We are pleased to inform you that we have received the equipment from JICA in the project for **"Strengthening Non-Revenue Water Control in Kigali City Water Network"** based on record of discussions signed on March 30, 2016 between WASAC and JICA.

The received equipment are for;
-Pressure reducing Valves (12), Float Valves (10) and related pipes & fittings.
-Water Level Meters (3 sets)
-Water Pressure Meters (3 sets)

We should take responsibility of the security, maintenance and keep them in good condition,
In addition, we would like to utilize them effectively even after the project.

Sincerely,

WATER & SANITATION CORPORATION WASAC CHIEF EXECUTIVE OFFICER

Eng. Aime MUZOLA
Chief Executive Officer

Attachment:
-List of equipment and related picture
CC:
Director of Support Services, WASAC Ltd

KYOWA ENGINEERING CONSULTANTS CO.,LTD.
Address: KEC Bldg., 1-62-11, Sasazuka, Shibuya-ku, Tokyo Japan, 151-0073
TEL: (03)3376-3178 FAX: (03)3320-6542

July 22, 2020

To: Eng. Aime MUZOLA
Chief Executive Officer
Water and Sanitation Corporation Limited

Re: Handover of the Equipment on the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network (NRW Project)

Dear Sir,

With reference to the Record of Discussions signed on March 30, 2016 between Water and Sanitation Corporation Ltd. (WASAC) and Japan International Cooperation Agency (JICA), we would like to hand over the following equipment listed as attached.

We humbly request WASAC to utilize them properly and maintain them in good condition.

1. Pressure Reducing Valves, Float Valves and Fittings
2. Pipes and Fittings for Pressure Reducing Valves
3. Water Level Meter
4. Water Pressure Meter

Sincerely,

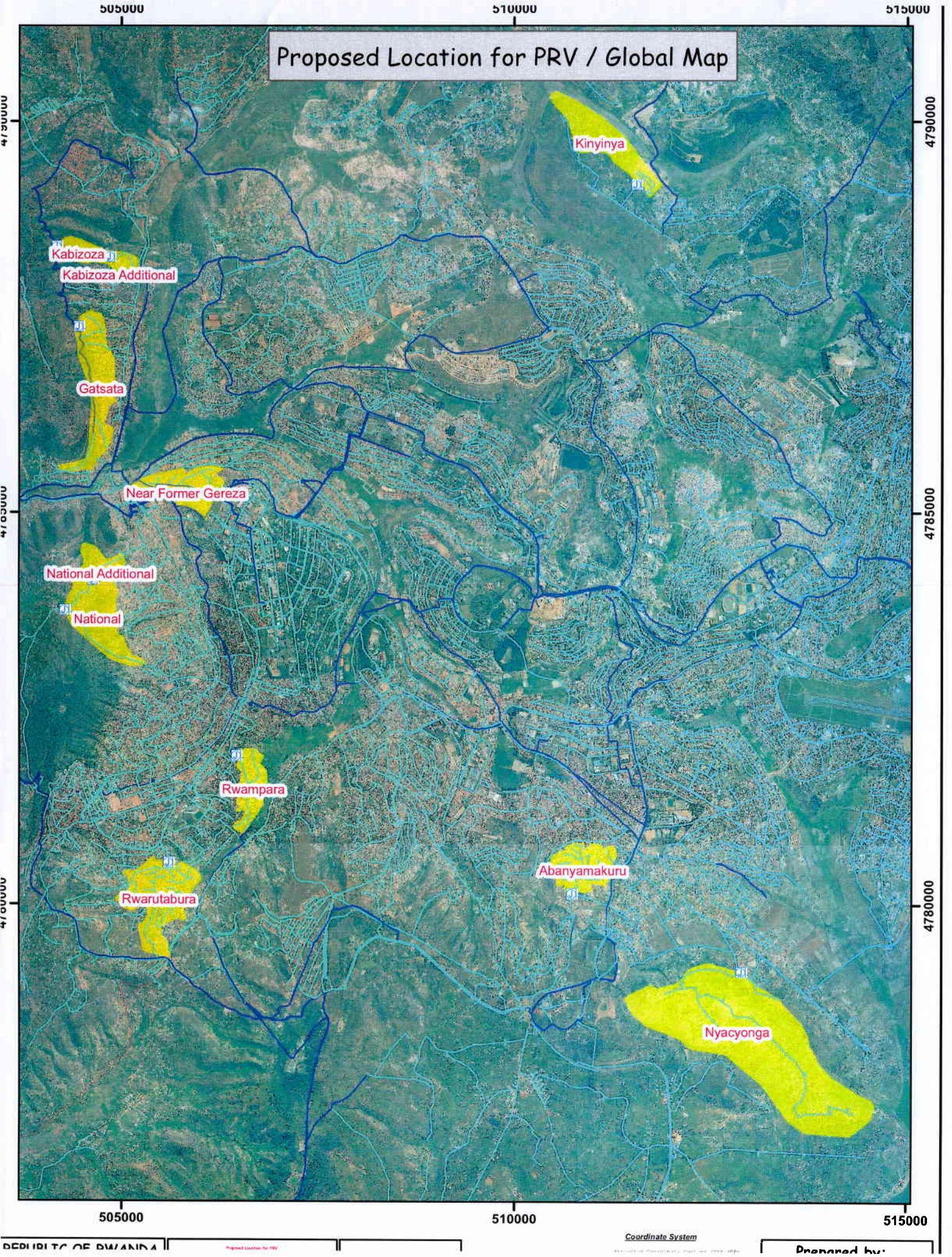
Shigeo OTANI
Chief Adviser, JICA Expert Team
Kyowa Engineering Consultants Co., Ltd.

Attachment:

- List of equipment
- Inspection record

CC:

- Director of Urban Water and Sanitation Services, WASAC Ltd.
- Director of Support Services, WASAC Ltd.



Coordinate System

Prepared by:

12 PRV installed.

NO	Names	Branch	Diameter (mm)	Bypass	Installation (including modification)	Photos
1	**Kabizoza**	Nyarugenge	80	with	Done	 
2	**Kabizoza Additional**	Nyarugenge	80	with	Done	 
3	**Gatsata**	Nyarugenge	150	with	Done	 
4	**Near Former Gereza**	Nyarugenge	100	without	Done	 
5	**National**	Nyarugenge	100	without	Done	 
6	**National Additional**	Nyarugenge	50	with	Done	 
7	**Rwampara**	Nyamirambo	80	without	Done	 
8	**Rwarutabura**	Nyamirambo	100	without	Done	 
9	**Mwendo-Rwesero, No.72 (on transmission pipe for the reservoir)**	Nyamirambo	100	without	Done	 
10	**Kinyinya**	Remera	80	without	Done	 
11	**Abanyamakuru**	Gikondo	150	with	Done	 
12	**Nyacyonga**	Gikondo	100	with	Done	 

10 float Valves

No	Reservoir Name	Branch	No	Measures to be taken	FV Installation (Date)	Photos
1	Mont Kigali Bas (Golf Mike-Nyakabanda) No.113	Nyamirambo	113	DN200x1, Gate Valve DN150x1	Not yet	The materials staying in store, until the trust blocs contructed for pipe protection.
2	Mwendo-Rwesero, No.72	Nyamirambo	72	DN100x1	Done	 
3	EP GIKONDO (Primaire), No.32	Gikondo	32	DN 100	done	 
4	EP GIKONDO (Primaire), No.32 → Murambi No.104	Gikondo	104	DN100x1, Gate Valve x2	Done	 
5	NYARURAMA, No.118	Gikondo	118	DN100x1	Not yet	
6	Gacuriro (Kadobogo PM3), No.24, 25	Kacyiru	24, 25	DN200x2, Gate Valve x 6	Done	 
7	Kibagabaga(Hospital), No.71	Remera	71	DN200x1	Done	 
8	Nyarutarama, No.121	Remera	121	DN100x1, gate Valve x1	Done	 
9	Chez lando, No.15	Remera	15	DN150x1	Done	
10	Ayabaraya (Gako), No.26	Kanombe	26	DN80x1, Other Fittings	Done	 

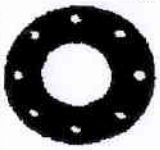
1. Pressure Reducing Valve, Float Valve and Fittings

ETS NAFOLD
TVA 100134053, CD N° 100134053,
RWANDA

Breakdown of the Quotation, and Specification

Procurement Work of Pressure Reducing Valve and Float Valve for
the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

No	Item	DN	Specification	Quantity	Unit Price (RWF)	Price (RWF)	PICTURES
1	Flanged Pressure Reducing Valve (PRV)	DN 150	Function: automatically reduce a higher inlet pressure to a steady lower downstream pressure, regardless of varying inlet pressure, by pilot-operated regulator capable holding downstream pressure to a pre-determined limit. Adjusted way: adjustment of the pressure by screw and nut of pilot valve system . Pressure: PN16 bars Structure: Ductile iron body, epoxy coating, with Pressure gauge up and down stream (0-20 bars)	2	1,457,600.00	2,915,200.00	
2	Flanged Pressure Reducing Valve (PRV)	DN 100	Same as above	5	737,300.00	3,686,500.00	
3	Flanged Pressure Reducing Valve (PRV)	DN 80	Same as above	4	584,800.00	2,339,200.00	
4	Flanged Pressure Reducing Valve (PRV)	DN 50 or 2	Same as above If 2" threaded flanges and Nipples are necessary to complete assembling.	1	82,600.00	82,600.00	
5	Flanged Gate Valve	DN 200	PN16, Ductile iron body, size F4	5	500,000.00	2,500,000.00	See the catalogue
6	Flanged Gate Valve	DN 150	PN16, Ductile iron body, size F4	3	400,000.00	1,200,000.00	
7	Flanged Gate Valve	DN 100	PN16, Ductile iron body, size F4	8	300,000.00	2,400,000.00	
8	Flanged Gate Valve	DN 80	PN16, Ductile iron body, size F4	5	200,000.00	1,000,000.00	
9	Flanged Gate Valve	DN 50	PN16, Ductile iron body, size F4	13	120,000.00	1,560,000.00	
10	Flanged filter for PRV	DN 150	PN16, Ductile iron body	2	360,000.00	720,000.00	
11	Flanged filter for PRV	DN 100	PN16, Ductile iron body	5	300,000.00	1,500,000.00	
12	Flanged filter for PRV	DN 80	PN16, Ductile iron body	4	240,000.00	960,000.00	
13	Flanged filter for PRV	DN 50 or 2	PN16, Ductile Iron body. If 2" threaded flanges and Nipples are necessary to complete assembling.	1	140,000	140,000.00	
14	All Flanged TEE	DN 150/50	PN16, Ductile Iron body	2	300,000	600,000.00	
15	All Flanged TEE	DN 100/50	PN16, Ductile iron body	5	240,000	1,200,000.00	
16	All Flanged TEE	DN 80/50	PN16, Ductile iron body	4	200,000	800,000.00	
17	All Flanged TEE	DN 50/50	PN16, Ductile iron body	1	140,000	140,000.00	
18	All Flanged TEE equal	DN 80/80	PN16, Ductile iron body	2	200,000	400,000.00	
19	Flanged High Speed Air Release Valve	DN 50	PN16, Ductile Iron body	12	140,000	1,680,000.00	See the catalogue
20	Flanged end Float valve with all accessories	DN 200	Function: Automatically controls the rate of filling, and will shut off when a predetermined water level is reached. Type: an equilibrium, single seat upstream piessure balanced float valve Installation body pattern: angle pattern Pressure: PN16 bars Max. allowable pressure drop (Dp) across the valve: more than 8 bar Structure: Ductile Iron body, epoxy coating, stainless steel float	4	160,000	640,000.00	See the catalogue
21	Flanged end Float valve with all accessories	DN 150	Same as above	1	140,000	140,000.00	See the catalogue
22	Flanged end Float valve with all accessories	DN 100	Same as above	4	60,000	240,000.00	See the catalogue

No	Item	DN	Specification	Quantity	Unit Price (RWF)	Price (RWF)	PICTURES
23	Flanged and Float valve with all accessories	DN 80	Same as above	1	40,000	40,000.00	See the catalogue
24	Flanged Anti return valve	DN 80	PN16, Ductile iron body	1	240,000	240,000.00	See the catalogue
25	Flanged Elbow	DN 100	PN16, Ductile iron body	2	240,000	480,000.00	
26	Flanged Elbow	DN 80	PN16, Ductile iron body	2	200,000	400,000.00	
27	Quick fit flange adaptor/ Coupling for Steel Pipe and PVC	DN 50 (OD63)	PN16, Ductile Iron body, EPDM gasket	2	40,000	80,000.00	
28	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 150	PN16, Ductile iron body	6	180,000	1,080,000.00	
29	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 100	PN16, Ductile iron body	8	90,000	720,000.00	
30	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 80	PN16, Ductile iron body	12	80,000	960,000.00	
31	Large Tolerance Flange Adapter for HDPE	DN 100	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4	140,000	560,000.00	
32	Large Tolerance Flange Adapter for HDPE	DN 80	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4	100,000	400,000.00	
33	Saddles	63 mmx3/4	PN 16, Ductile iron body	2	50,000	100,000.00	See the catalogue
34	Nipples	3/4"	PN 20, Galvanized body	2	1,000	2,000.00	See the catalogue
35	Reducer	3/4" / 1/2"	PN 20, Galvanized body, Outside screw: 3/4", Inside screw: 1/2"	2	1,000	2,000.00	See the catalogue
36	Nipples	1/2"	PN 20, Galvanized body	4	800	3,200.00	See the catalogue
37	Ball valve	1/2"	PN 20, Galvanized body, Inside screw	2	8,000	16,000.00	See the catalogue
38	Flat Gaskets	DN 200	Plastic or caoutchouc, EPDM gasket	16	12,000	192,000.00	
39	Flat Gaskets	DN 150	Plastic or caoutchouc, EPDM gasket	15	8,000	120,000.00	
40	Flat Gaskets	DN 100	Plastic or caoutchouc, EPDM gasket	41	4,000	164,000.00	
41	Flat Gaskets	DN 80	Plastic or caoutchouc, EPDM gasket	48	3,000	144,000.00	
42	Flat Gaskets	DN 50	Plastic or caoutchouc, EPDM gasket	32	2,000	64,000.00	
43	Bolt and nuts	M 20x80	Galvanized steel body, hexagonal head, entirely threaded	300	2,400	720,000.00	
44	Bolt and nuts	M 16x80	Galvanized steel body, hexagonal head, entirely threaded	832	1,200	998,400.00	
	Total without VAT(RWF)					**34,329,100.00**	
	VAT (18%) RWF					**6,179,238.00**	
	Total price with VAT (Rwf)					**40,508,338.00**	
	Total without VAT (USD)					**37,112.00**	
	VAT (18%) USD					**6,680.00**	
	Total price with VAT (USD)					**43,792.00**	

N.B.

1. All the proposed materials are made by SOVEMA in Europe (France)
2. Delivery Time is one month after signing the contract
3. We are ready to provide all complimentary technical clarifications in regard of our offer
4. For items number 1 to 4, item 46 and item 47, we have suggested two options for each. You are welcome to pick one

Done at Kigali on 16/10/2019
Froduald NAHIMANA
Managing Director
Ets NAFOLD

ETS NAFOLD
TEL: [illegible] B.P [illegible]
KIGALI-RWANDA

Phases of Delivering and Reception for Pressure Reducing Valve and Float Valve for the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

No	Item	DN	Specification	Quantity	First Reception	Second Reception	Third Reception
1	Flanged Pressure Reducing Valve (PRV)	DN 150	Function: automatically reduce a higher inlet pressure to a steady lower downstream pressure, regardless of varying inlet pressure, by pilot-operated regulator capable holding downstream pressure to a pre-determined limit. Adjusted way: adjustment of the pressure by screw and nut of pilot valve system . Pressure: PN16 bars Structure: Ductile Iron body, epoxy coating, with Pressure gauge up and down stream (0-20 bars)	2	2		
2	Flanged Pressure Reducing Valve (PRV)	DN 100	Same as above	5	5		
3	Flanged Pressure Reducing Valve (PRV)	DN 80	Same as above	4	4		
4	Flanged Pressure Reducing Valve (PRV)	DN 50 or 2"	Same as above If 2" threaded flanges and Nipples are necessary to complete assembling.	1	1		
5	Flanged Gate Valve	DN 200	PN16, Ductile iron body, size F4	5		5	
6	Flanged Gate Valve	DN 150	PN16, Ductile iron body, size F4	3		3	
7	Flanged Gate Valve	DN 100	PN16, Ductile iron body, size F4	8		8	
8	Flanged Gate Valve	DN 80	PN16, Ductile iron body, size F4	5		5	
9	Flanged Gate Valve	DN 50	PN16, Ductile iron body, size F4	13		13	
10	Flanged filter for PRV	DN 150	PN16, Ductile Iron body	2		2	
11	Flanged filter for PRV	DN 100	PN16, Ductile iron body	5		5	
12	Flanged filter for PRV	DN 80	PN16, Ductile iron body	4		4	
13	Flanged filter for PRV	DN 50 or 2"	PN16, Ductile Iron body. If 2" threaded flanges and Nipples are necessary to complete assembling.	1		1	
14	All Flanged TEE	DN 150/50	PN16, Ductile Iron body	2		2	
15	All Flanged TEE	DN 100/50	PN16, Ductile iron body	5		5	
16	All Flanged TEE	DN 80/50	PN16, Ductile iron body	4		4	
17	All Flanged TEE	DN 50/50	PN16, Ductile iron body	1		1	
18	All Flanged TEE equal	DN 80/80	PN16, Ductile iron body	2		2	
19	Flanged High Speed Air Release Valve	DN 50	PN16, Ductile Iron body	12		12	
20	Flanged end Float valve with all accessories	DN 200	Function: Automatically controls the rate of filling, and will shut off when a predetermined water level is reached. Type: an equilibrium, single seat upstream pressure balanced float valve Installation body pattern: angle pattern. Pressure: PN16 bars Max. allowable pressure drop (Dp) across the valve: more than 8 bar Structure: Ductile Iron body, epoxy coating, stainless steel float	4			4
21	Flanged end Float valve with all accessories	DN 150	Same as above	1			1
22	Flanged end Float valve with all accessories	DN 100	Same as above	4			4
23	Flanged end Float valve with all accessories	DN 80	Same as above	1			1

No	Item	DN	Specification	Quantity	First Reception	Second Reception	Third Reception
24	Flanged Anti return valve	DN 80	PN16, Ductile iron body	1		1	
25	Flanged Elbow	DN 100	PN16, Ductile iron body	2		2	
26	Flanged Elbow	DN 80	PN16, Ductile iron body	2		2	
27	Quick Flange Adapter for PVC	DN 150 (OD160)	PN16, Ductile Iron body, EPDM gasket	4		4	
28	Quick flange Adapter for PVC	DN 100 (OD110)	PN16, Ductile Iron body, EPDM gasket	6		6	
29	Quick flange Adapter for PVC	DN 80 (OD90)	PN16, Ductile Iron body, EPDM gasket	4		4	
30	Quick flange Adapter for PVC	DN 50 (OD63)	PN16, Ductile Iron body, EPDM gasket	2		2	
31	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 150	PN16, Ductile iron body	2		2	
32	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 100	PN16, Ductile iron body	2		2	
33	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 80	PN16, Ductile iron body	8		8	
34	Large Tolerance Flange Adapter for HDPE	DN 100	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4		4	
35	Large Tolerance Flange Adapter for HDPE	DN 80	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4		4	
36	Saddles	63 mmx3/4"	PN 16, Ductile iron body	2		2	
37	Nipples	3/4"	PN 20, Galvanized body	2		2	
38	Reducer	3/4" / 1/2"	PN 20, Galvanized body, Outside screw: 3/4", Inside screw: 1/2"	2		2	
39	Nipples	1/2"	PN 20, Galvanized body	4		4	
40	Ball valve	1/2"	PN 20, Galvanized body, Inside screw	2		2	
41	Flat Gaskets	DN 200	Plastic or caoutchouc, EPDM gasket	16		16	
42	Flat Gaskets	DN 150	Plastic or caoutchouc, EPDM gasket	15		15	
43	Flat Gaskets	DN 100	Plastic or caoutchouc, EPDM gasket	41		41	
44	Flat Gaskets	DN 80	Plastic or caoutchouc, EPDM gasket	48		48	
45	Flat Gaskets	DN 50	Plastic or caoutchouc, EPDM gasket	32		32	
46	Bolt and nuts	M 20x80	Galvanized steel body, hexagonal head, entirely threaded	300	300		
47	Bolt and nuts	M 16x80	Galvanized steel body, hexagonal head, entirely threaded	832	832		

FIRST INSPECTION RECORD

SIGNED ON 13/12/2019

REFERENCE: DELIVERY NOTE ON 10/12/2019

ETS NAFOLD
B.P. 2961 KIGALI
Phone: + 250 788527031
TVA 10013405, TIN Nº 100134053,
E-mail: nafold2005@gmail.com
KIGALI-RWANDA

DELIVERY NOTE Nº 002/2019

Client: KYOWA ENGINEERING CONSULTANTS CO., LTD

No	Item	DN	Specification	Quantity
1	Flanged Pressure Reducing Valve (PRV)	DN 150	Function: automatically reduce a higher inlet pressure to a steady lower downstream pressure, regardless of varying inlet pressure, by pilot-operated regulator capable holding downstream pressure to a pre-determined limit. Adjusted way: adjustment of the pressure by screw and nut of pilot valve system . Pressure: PN16 bars Structure: Ductile Iron body, epoxy coating, with Pressure gauge up and down stream (0-20 bars)	2 ✓
2	Flanged Pressure Reducing Valve (PRV)	DN 100	Same as above	5 ✓
3	Flanged Pressure Reducing Valve (PRV)	DN 80	Same as above	4 ✓
4	Flanged Pressure Reducing Valve (PRV)	DN 50 or 2"	Same as above If 2" threaded flanges and Nipples are necessary to complete assembling.	1 ✓
Bolt and nuts	M 20x80	Galvanized steel body, hexagonal head, entirely threaded	Bolt and nuts	M 20x80 300 ✓
Bolt and nuts	M 16x80	Galvanized steel body, hexagonal head, entirely threaded	Bolt and nuts	M 16x80 832 ✓

Delivered by: Ets NAFOLD/Froduald NAHIMANA Represented by Rwaro Berthe Date: 10/12/2019 Sign.....

Received by ITANGISHAKA Vedaste Date: 10/12/2019 Sign.....

Before the inspection records, the materials delivered are still in the supplier responsibilities.

Done at Kigali on 10/12/2019
For Ets NAFOLD

ETS NAFOLD
TEL:.....B.P.....
KIGALI-RWANDA

Inspection Record

Procurement Work of Pressure Reducing Valve and Float Valve for
the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

Date: 13/12/2019

No	Item	DN	Specification	Contract Quantity	Inspection Quantity	Remark
1	Flanged Pressure Reducing Valve (PRV)	DN 150	Function: automatically reduce a higher inlet pressure to a steady lower downstream pressure, regardless of varying inlet pressure, by pilot-operated regulator capable holding downstream pressure to a pre-determined limit. Adjusted way: adjustment of the pressure by screw and nut of pilot valve system . Pressure: PN16 bars Structure: Ductile Iron body, epoxy coating, with Pressure gauge up and down stream (0-20 bars)	2	✓	Available in Gikondo Store
2	Flanged Pressure Reducing Valve (PRV)	DN 100	Same as above	5	✓	Gikondo store
3	Flanged Pressure Reducing Valve (PRV)	DN 80	Same as above	4	✓	Gikondo store
4	Flanged Pressure Reducing Valve (PRV)	DN 50 or 2"	Same as above If 2" threaded flanges and Nipples are necessary to complete assembling.	1	✓	Gikondo store
5	Flanged Gate Valve	DN 200	PN16, Ductile iron body, size F4	5		Not available
6	Flanged Gate Valve	DN 150	PN16, Ductile iron body, size F4	3		Not available
7	Flanged Gate Valve	DN 100	PN16, Ductile iron body, size F4	8		Not available
8	Flanged Gate Valve	DN 80	PN16, Ductile iron body, size F4	5		Not available
9	Flanged Gate Valve	DN 50	PN16. Ductile iron body. size F4	13		Not available
10	Flanged filter for PRV	DN 150	PN16. Ductile Iron body	2		Not available
11	Flanged filter for PRV	DN 100	PN16. Ductile iron body	5		Not available
12	Flanged filter for PRV	DN 80	PN16, Ductile iron body	4		Not available
13	Flanged filter for PRV	DN 50 or 2"	PN16, Ductile Iron body. If 2" threaded flanges and Nipples are necessary to complete assembling.	1		Not available
14	All Flanged TEE	DN 150/50	PN16, Ductile Iron body	2		Not available
15	All Flanged TEE	DN 100/50	PN16. Ductile iron body	5		Not available
16	All Flanged TEE	DN 80/50	PN16. Ductile iron body	4		Not available
17	All Flanged TEE	DN 50/50	PN16, Ductile iron body	1		Not available
18	All Flanged TEE equal	DN 80/80	PN16, Ductile iron body	2		Not available
19	Flanged High Speed Air Release Valve	DN 50	PN16. Ductile Iron body	12		Not available
20	Flanged end Float valve with all accessories	DN 200	Function: Automatically controls the rate of filling, and will shut off when a predetermined water level is reached. Type: an equilibrium, single seat upstream pressure balanced float valve Installation body pattern: angle pattern. Pressure: PN16 bars Max. allowable pressure drop (Dp) across the valve: more than 8 bar Structure: Ductile Iron body, epoxy coating, stainless steel float	4		Not available
21	Flanged end Float valve with all accessories	DN 150	Same as above	1		Not available
22	Flanged end Float valve with all accessories	DN 100	Same as above	4		Not available
23	Flanged end Float valve with all accessories	DN 80	Same as above	1		Not available
24	Flanged Anti return valve	DN 80	PN16, Ductile iron body	1		Not available
25	Flanged Elbow	DN 100	PN16. Ductile iron body	2		Not available

No	Item	DN	Specification	Contract Quantity	Inspection Quantity	Remark
26	Flanged Elbow	DN 80	PN16, Ductile iron body	2		Not available
27	Quick flange Adapter for PVC	DN 50 (OD63)	PN16, Ductile Iron body, EPDM gasket	2		Not available
28	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 150	PN16, Ductile iron body	6		Not available
29	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 100	PN16, Ductile iron body	8		Not available
30	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 80	PN16, Ductile iron body	12		Not available
31	Large Tolerance Flange Adapter for HDPE	DN 100	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4		Not available
32	Large Tolerance Flange Adapter for HDPE	DN 80	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4		Not available
33	Saddles	63 mmx3/4"	PN 16, Ductile iron body	2		Not available
34	Nipples	3/4"	PN 20, Galvanized body	2		Not available
35	Reducer	3/4" / 1/2"	PN 20, Galvanized body, Outside screw: 3/4", Inside screw: 1/2"	2		Not available
36	Nipples	1/2"	PN 20, Galvanized body	4		Not available
37	Ball valve	1/2"	PN 20, Galvanized body, Inside screw	2		Not available
38	Flat Gaskets	DN 200	Plastic or caoutchouc, EPDM gasket	16		Not available
39	Flat Gaskets	DN 150	Plastic or caoutchouc, EPDM gasket	15		Not available
40	Flat Gaskets	DN 100	Plastic or caoutchouc, EPDM gasket	41		Not available
41	Flat Gaskets	DN 80	Plastic or caoutchouc, EPDM gasket	48		Not available
42	Flat Gaskets	DN 50	Plastic or caoutchouc, EPDM gasket	32		Not available
43	Bolt and nuts	M 20x80	Galvanized steel body, hexagonal head, entirely threaded	300	✓	Gikondo store
44	Bolt and nuts	M 16x80	Galvanized steel body, hexagonal head, entirely threaded	832	✓	Gikondo Store

Member of Inspection

WASAC

NAME	POSITION	SIGNATURE
UWUMUREMYI Félicien	Standard & Quality Control officer	
Désiré Ntamuhanga	Head of Leak detection & Pressure Mgt	

JAICA

NAME	POSITION	SIGNATURE
Vedaste ITANGISHAKA	Assistant NRW project	
Masanori MATSUSUMI	JICA expert	

CONTRACTOR

NAME	POSITION	SIGNATURE
Frodouald Nahimana	General manager	

SECOND INSPECTION RECORD

SIGNED ON 31/12/2019

REFERENCE: DELIVERY NOTE ON 31/12/2019

ETS NAFOLD
B.P. 2961 KIGALI
Phone: + 250 788527031
TVA 10013405, TIN Nº 100134053,
E-mail: nafold2005@gmail.com
KIGALI-RWANDA

DELIVERY NOTE Nº 003/2019

Client: KYOWA ENGINEERING CONSULTANTS CO., LTD

Procurement Work of Pressure Reducing Valve and Float Valve for the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

1	Flanged Gate Valve	DN 200	PN16, Ductile iron body, size F4	5
2	Flanged Gate Valve	DN 150	PN16, Ductile iron body, size F4	3
3	Flanged Gate Valve	DN 100	PN16, Ductile iron body, size F4	8
4	Flanged Gate Valve	DN 80	PN16, Ductile iron body, size F4	5
5	Flanged Gate Valve	DN 50	PN16, Ductile iron body, size F4	13
6	Flanged filter for PRV	DN 150	PN16, Ductile Iron body	2
7	Flanged filter for PRV	DN 100	PN16, Ductile iron body	5
8	Flanged filter for PRV	DN 80	PN16, Ductile iron body	4
9	Flanged filter for PRV	DN 50 or 2"	PN16, Ductile Iron body. If 2" threaded flanges and Nipples are necessary to complete assembling.	1
10	All Flanged TEE	DN 150/50	PN16, Ductile Iron body	2
11	All Flanged TEE	DN 100/50	PN16, Ductile iron body	5
12	All Flanged TEE	DN 80/50	PN16, Ductile iron body	4
13	All Flanged TEE	DN 50/50	PN16, Ductile iron body	1
14	All Flanged TEE equal	DN 80/80	PN16, Ductile iron body	2
15	Flanged High Speed Air Release Valve	DN 50	PN16, Ductile Iron body	12
16	Flanged Anti return valve	DN 80	PN16, Ductile iron body	1
17	Flanged Elbow	DN 100	PN16, Ductile iron body	2
18	Flanged Elbow	DN 80	PN16, Ductile iron body	2
19	Quick fit flange adaptor/ Coupling for Steel Pipe and PVC	DN 50 (OD63)	PN16, Ductile Iron body, EPDM gasket	2

ETS NAFOLD
B.P. 2961 KIGALI
Phone: + 250 788527031
TVA 10013405, TIN Nº 100134053,
E-mail: nafold2005@gmail.com
KIGALI-RWANDA

20	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 150	PN16, Ductile iron body	6
21	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 100	PN16, Ductile iron body	8
22	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 80	PN16, Ductile iron body	12
23	Large Tolerance Flange Adapter for HDPE	DN 100	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4
24	Large Tolerance Flange Adapter for HDPE	DN 80	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4
25	Saddles	63 mmx3/4"	PN 16, Ductile iron body	2
26	Nipples	3/4"	PN 20, Galvanized body	2
27	Reducer	3/4" / 1/2"	PN 20, Galvanized body, Outside screw: 3/4", Inside screw. 1/2"	2
28	Nipples	1/2"	PN 20, Galvanized body	4
29	Ball valve	1/2"	PN 20, Galvanized body, Inside screw	2
30	Flat Gaskets	DN 200	Plastic or caoutchouc, EPDM gasket	16
31	Flat Gaskets	DN 150	Plastic or caoutchouc, EPDM gasket	15
32	Flat Gaskets	DN 100	Plastic or caoutchouc, EPDM gasket	41
33	Flat Gaskets	DN 80	Plastic or caoutchouc, EPDM gasket	48
34	Flat Gaskets	DN 50	Plastic or caoutchouc, EPDM gasket	32

Delivered by: Ets NAFOLD/Froduald NAHIMANA Date: 31/12/2019 Sign.....

Received by: JICA/ ITANGISHAKA Vedaste Date: 31/12/2019 Sign.....

Before the inspection records, the materials delivered are still in the supplier responsibilities (Specifications and quality).

Inspection Record

Procurement Work of Pressure Reducing Valve and Float Valve for the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

Date:

No	Item	DN	Specification	Contract Quantity	Inspection Quantity	Remark
1	Flanged Gate Valve	DN 200	PN16, Ductile iron body, size F4	5	5	Received
2	Flanged Gate Valve	DN 150	PN16, Ductile iron body, size F4	3	3	Received
3	Flanged Gate Valve	DN 100	PN16, Ductile iron body, size F4	8	8	Received
4	Flanged Gate Valve	DN 80	PN16, Ductile iron body, size F4	5	5	Received
5	Flanged Gate Valve	DN 50	PN16, Ductile iron body, size F4	13	13	Received
6	Flanged filter for PRV	DN 150	PN16, Ductile Iron body	2	2	Received
7	Flanged filter for PRV	DN 100	PN16, Ductile iron body	5	5	Received
8	Flanged filter for PRV	DN 80	PN16, Ductile iron body	4	4	Received
9	Flanged filter for PRV	DN 50 or 2"	PN16, Ductile Iron body. If 2" threaded flanges and Nipples are necessary to complete assembling.	1	1	Received
10	All Flanged TEE	DN 150/50	PN16, Ductile Iron body	2	2	Received
11	All Flanged TEE	DN 100/50	PN16, Ductile iron body	5	5	Received
12	All Flanged TEE	DN 80/50	PN16, Ductile iron body	4	4	Received
13	All Flanged TEE	DN 50/50	PN16, Ductile iron body	1	1	Received
14	All Flanged TEE equal	DN 80/80	PN16, Ductile iron body	2	2	Received
15	Flanged High Speed Air Release Valve	DN 50	PN16, Ductile Iron body	12	12	Received
16	Flanged end Float valve with all accessories	DN 200	Function: Automatically controls the rate of filling, and will shut off when a predetermined water level is reached. Type: an equilibrium, single seat upstream pressure balanced float valve Installation body pattern: angle pattern. Pressure: PN16 bars Max. allowable pressure drop (Dp) across the valve: more than 8 bar Structure: Ductile Iron body, epoxy coating, stainless steel float	4	0	Not available
17	Flanged end Float valve with all accessories	DN 150	Same as above	1	0	Not available
18	Flanged end Float valve with all accessories	DN 100	Same as above	4	0	Not available
19	Flanged end Float valve with all accessories	DN 80	Same as above	1	0	Not available
20	Flanged Anti return valve	DN 80	PN16, Ductile iron body	1	1	Received
21	Flanged Elbow	DN 100	PN16, Ductile iron body	2	2	Received
22	Flanged Elbow	DN 80	PN16, Ductile iron body	2	2	Received
23	Quick flange Adapter for PVC	DN 50 (OD63)	PN16, Ductile Iron body, EPDM gasket	2	2	Received
24	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 150	PN16, Ductile iron body	6	6	Received
25	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 100	PN16, Ductile iron body	8	8	Received
26	Quick fit flange adaptor/ Coupling for Steel Pipe	DN 80	PN16, Ductile iron body	12	12	Received

27	Large Tolerance Flange Adapter for HDPE	DN 100	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4	4	Received
28	Large Tolerance Flange Adapter for HDPE	DN 80	PN16, Ductile Iron body, brass grip ring and EPDM gasket	4	4	Received
29	Saddles	63 mmx3/4"	PN 16, Ductile iron body	2	2	Received
30	Nipples	3/4"	PN 20, Galvanized body	2	2	Received
31	Reducer	3/4" / 1/2"	PN 20, Galvanized body, Outside screw: 3/4", Inside screw: 1/2"	2	2	Received
32	Nipples	1/2"	PN 20, Galvanized body	4	4	Received
33	Ball valve	1/2"	PN 20, Galvanized body, Inside screw	2	2	Received
34	Flat Gaskets	DN 200	Plastic or caoutchouc, EPDM gasket	16	16	Received
35	Flat Gaskets	DN 150	Plastic or caoutchouc, EPDM gasket	15	15	Received
36	Flat Gaskets	DN 100	Plastic or caoutchouc, EPDM gasket	41	41	Received
37	Flat Gaskets	DN 80	Plastic or caoutchouc, EPDM gasket	48	48	Received
38	Flat Gaskets	DN 50	Plastic or caoutchouc, EPDM gasket	32	32	Received

Member of Inspection

WASAC

NAME	POSITION	SIGNATURE
IWUNU RENYI Felicien	Standard & Quality Control officer	
MUGABO JML	leak detection & pressure mgt operator	

JICA

NAME	POSITION	SIGNATURE
Masanobu MAYUSUMI	JICA expert	
Tadaste TANIGISHIMA	Assistant NRW project /WASAC-JICA	

CONTRACTOR

NAME	POSITION	SIGNATURE
Frodouald Habimana	Managing Director	

0782527031 B.P. 2561
KIGALI - RWANDA

THIRD INSPECTION RECORD

SIGNED ON 10/1/2020

REFERENCE: DELIVERY NOTE ON 9/1/2020

ETS NAFOLD
B.P. 2961 KIGALI
Phone: + 250 788527031
TVA 10013405, TIN N° 100134053,
E-mail: nafold2005@gmail.com
KIGALI-RWANDA

DELIVERY NOTE N° 001/2020

Client: KYOWA ENGINEERING CONSULTANTS CO., LTD

Procurement Work of Pressure Reducing Valve and Float Valve for the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

NO	Items	DN	Specifications	DN
1	Flanged end Float valve with all accessories	DN 200	Function: Automatically controls the rate of filling, and will shut off when a predetermined water level is reached. Type: an equilibrium, single seat upstream pressure balanced float valve Installation body pattern: angle pattern. Pressure: PN16 bars Max. allowable pressure drop (Dp) across the valve: more than 8 bar Structure: Ductile iron body, epoxy coating, stainless steel float	4
2	Flanged end Float valve with all accessories	DN 150	Same as above	1
3	Flanged end Float valve with all accessories	DN 100	Same as above	4
4	Flanged end Float valve with all accessories	DN 80	Same as above	1

Delivered by: Ets NAFOLD/Froduald NAHIMANA Date: 09/01/2020 Sign.....

Received by ITANGISHAKA Vedaste Date: 09/01/2020 Sign.....

Before the inspection records, the materials delivered are still in the supplier responsibilities (Specifications and quality).

Inspection Record

Procurement Work of Pressure Reducing Valve and Float Valve for
the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

Date: 10th January 2020

No	Item	DN	Specification	Contract Quantity	Inspection Quantity	Remark
20	Flanged end Float valve with all accessories	DN 200	Function: Automatically controls the rate of filling, and will shut off when a predetermined water level is reached. Type: an equilibrium, single seat upstream pressure balanced float valve Installation body pattern: angle pattern. Pressure: PN16 bars Max. allowable pressure drop (Dp) across the valve: more than 8 bar Structure: Ductile Iron body, epoxy coating, stainless steel float	4	4	Received
21	Flanged end Float valve with all accessories	DN 150	Same as above	1	1	Received
22	Flanged end Float valve with all accessories	DN 100	Same as above	4	4	Received
23	Flanged end Float valve with all accessories	DN 80	Same as above	1	1	Received

Member of Inspection

WASAC

NAME	POSITION	SIGNATURE
UWUMUREMYI Felicien	Standard & quality Control officer	
MUGABO J.MV	Leak detection and pressure mgt Operator	

JAICA

NAME	POSITION	SIGNATURE
Masanobu MAYUSUMI	JICA expert	
Vedaste ITANGISHAKA	Assistant NRW project WASAC - JICA	

CONTRACTOR

NAME	POSITION	SIGNATURE
NAHIMANA Muhire Philippe	Operations Manager	

ETS NAFOHEB
TEL: 078852303 B.P. 2961
KIGALI - RWANDA

2. Pipe and Fittings for Pressure Reducing Valve

PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK
CHECK LIST OF PRICE COMPETITION FOR THE PROCUREMENT WORK FOR PIPES AND FITTINGS

Submitted Documents for Procurement Work of the Products

Date: November 28, 2019

No	Company	Submission of the Requested Documents	Form-1		Form-2	Form-3	Remarks
			Quotation of the Work	Quotation Price	Breakdown of the Quotation, and Specification	Procurement Schedule	
1	JINMAO	☐ Submitted	☑	USD. 11,942	☑	☑	
2	QUINCALLERIE BETA	☐ No Submission	☐	USD.	☐	☐	No Submission
3	NEW EARTH CONSTRUCTION COMPANY	☐ Submitted	☑	USD. 12,587	☑	☑	

Nobuyuki TSUTSUI
Kyowa Engineering Consultants

Masanobu Mayusumi
Long Term Expert, JICA

Received 28/11/2019.

Desire Ntamuturano
Head of Leak Detection and Pressure Management, NRW
WASAC

Felicien Uwumuremyi
Standard officer
WASAC

KYOWA ENGINEERING CONSULTANTS CO.,LTD.
Address: KEC Bldg., 1-62-11, Sasazuka, Shibuya-ku, Tokyo Japan, 151-0073
TEL: (03)3376-3178 FAX: (03)3320-6542

PURCHASE ORDER No.PAF-01

Date: November 29, 2019

Address to:

Name : JINMAO RWANDA LTD
Address : Gasabo, Kacyiru, Kibazi, Kigali - RWANDA
Tel :0788513878 / 0788411188 Email: tuyishimejuan@gmail.com

Project Name:

Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

Order Products:

No	Item	DN	Specification	Quantity	Unit Price (RWF)	Price (RWF)
1	Flanged Gate Valve	DN 150	PN16, Ductile iron body, size F4	2	250,000	500,000
2	Flanged Gate Valve	DN100	PN16, Ductile iron body, size F4	2	200,000	400,000
3	Flanged Gate Valve	DN80	PN16, Ductile iron body, size F4	5	180,000	900,000
4	Flanged Gate Valve	DN 50	PN16, Ductile iron body, size F4	3	120,000	360,000
5	All Flanged TEE	DN 150/80	PN16, Ductile iron body	4	250,000	1,000,000
6	All Flanged TEE	DN 100/80	PN16, Ductile iron body	2	200,000	400,000
7	All Flanged TEE	DN 80/80	PN16, Ductile iron body	4	150,000	600,000
8	All Flanged TEE	DN 80/50	PN16, Ductile iron body	2	120,000	240,000
9	All Flanged TEE	DN 50/50	PN16, Ductile iron body	2	120,000	240,000
10	Flanged Elbow	DN 100	PN16, Ductile iron body	2	130,000	260,000
11	Flanged Elbow	DN 80	PN16, Ductile iron body	6	120,000	720,000
12	Flanged Elbow	DN 50	PN16, Ductile iron body	4	100,000	400,000
13	Quick flange Adapter for PVC	DN 100 (OD110)	PN16, Ductile iron body, EPDM gasket	2	90,000	180,000
14	Quick flange Adapter for PVC	DN 150 (OD160)	PN16, Ductile iron body, EPDM gasket	2	120,000	240,000
15	Quick flange Adapter for PVC	DN 80 (OD90)	PN16, Ductile iron body, EPDM gasket	6	75,000	450,000
16	Quick flange Adapter for PVC	DN 50 (OD63)	PN16, Ductile iron body, EPDM gasket	4	60,000	240,000
17	Flat Gaskets	DN 150	Plastic or caoutchouc, EPDM gasket	6	10,000	60,000
18	Flat Gaskets	DN100	Plastic or caoutchouc, EPDM gasket	6	8,000	48,000
19	Flat Gaskets	DN 80	Plastic or caoutchouc, EPDM gasket	32	5,000	160,000
20	Flat Gaskets	DN 50	Plastic or caoutchouc, EPDM gasket	20	3,000	60,000
21	Bolt and nuts	M 20x80	Galvanized steel body, hexagonal head, entirely threaded	242	3,500	847,000
22	Bolt and nuts	M 16x80	Galvanized steel body, hexagonal head, entirely threaded	317	2,500	792,500
23	PVC	DN 100 (OD110)	PN16, with joint	1	90,000	90,000
24	PVC	DN 80 (OD90)	PN16	2	80,000	160,000
25	PVC	DN50 (OD63)	PN16	2	60,000	120,000
	Total withour VAT(RWF)					9,467,500
	VAT(RWF)					1,704,150
	TOTAL(RWF)					11,171,650

KYOWA ENGINEERING CONSULTANTS CO.,LTD.
Address: KEC Bldg., 1-62-11, Sasazuka, Shibuya-ku, Tokyo Japan, 151-0073
TEL: (03)3376-3178 FAX: (03)3320-6542

Total without VAT(US Dollar)					10,126
VAT (US Dollar)					1,823
Total (US Dollar)					11,948

Note:

1. Payment amount is Eleven Thousands and Nine Hundred Forty-Eight US Dollars (US$11,948)
2. Lump-sum Payment will be made upon approval of acceptance inspection of the Products by means of remittance within ten (10) working days after receiving the Invoice and Delivery Note,
3. Delivery place of the products is "JICA-WASAC Store at Gikondo Industrial Park, Kigali City.
4. The delivery shall be complete before the 30th December, 2019

Buyer:

Kyowa Engineering Consultants Co., Ltd. (KEC)
62-11, Sasazuka 1-chome, Shibuya-ku, Tokyo, Japan
Tel :+81-3-3376-3178, Fax :+81-3-3376-6542
Contact Address in Rwanda;
Address : WASAC DUWSS, KN82 St. in front of REG, Kigali - RWANDA
Tel. : 0788-537-229
E-mail : shakavedaste@yahoo.fr
Attention: ITANGISHAKA Vedaste, Assistant Engineer

Nobuyuki TSUTSUI
Kyowa Engineering Consultants Co., Ltd.
Tokyo, Japan

Inspection Record

Procurement Work of Pressure Reducing Pipes and Fittings for the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

Date: 13/12/2019

No	Item	DN	Specification	Contract Quantity	Inspection Quantity	Remark
1	Flanged Gate Valve	DN 150	PN16, Ductile iron body, size F4	2	✓	Received
2	Flanged Gate Valve	DN100	PN16, Ductile iron body, size F4	2	✓	Received
3	Flanged Gate Valve	DN80	PN16, Ductile iron body, size F4	5	✓	Received
4	Flanged Gate Valve	DN 50	PN16, Ductile iron body, size F4	3	✓	Received
5	All Flanged TEE	DN 150/80	PN16, Ductile iron body	4	✓	Received
6	All Flanged TEE	DN 100/80	PN16, Ductile iron body	2	✓	Received
7	All Flanged TEE	DN 80/80	PN16, Ductile iron body	4	✓	Received
8	All Flanged TEE	DN 80/50	PN16, Ductile iron body	2	✓	Received
9	All Flanged TEE	DN 50/50	PN16, Ductile iron body	2	✓	Received
10	Flanged Elbow	DN 100	PN16, Ductile iron body	2	✓	Received
11	Flanged Elbow	DN 80	PN16, Ductile iron body	6	✓	Received
12	Flanged Elbow	DN 50	PN16, Ductile iron body	4	✓	Received
13	Quick flange Adapter for PVC	DN 100 (OD110)	PN16, Ductile iron body, EPDM gasket	2	✓	Received
14	Quick flange Adapter for PVC	DN 150 (OD160)	PN16, Ductile iron body, EPDM gasket	2	✓	Received
15	Quick flange Adapter for PVC	DN 80 (OD90)	PN16, Ductile iron body, EPDM gasket	6	✓	Received
16	Quick flange Adapter for PVC	DN 50 (OD63)	PN16, Ductile iron body, EPDM gasket	4	✓	Received
17	Flat Gaskets	DN 150	Plastic or caoutchouc, EPDM gasket	6	✓	Received
18	Flat Gaskets	DN100	Plastic or caoutchouc, EPDM gasket	6	✓	Received
19	Flat Gaskets	DN 80	Plastic or caoutchouc, EPDM gasket	32	✓	Received
20	Flat Gaskets	DN 50	Plastic or caoutchouc, EPDM gasket	20	✓	Received
21	Bolt and nuts	M 20x80	Galvanized steel body, hexagonal head, entirely threaded	242	✓	Received
22	Bolt and nuts	M 16x80	Galvanized steel body, hexagonal head, entirely threaded	317	✓	Received
23	PVC	DN 100 (OD110)	PN16, with joint	1	✓	Received
24	PVC	DN 80 (OD90)	PN16	2	✓	Received
25	PVC	DN50 (OD63)	PN16	2	✓	Received

Member of Inspection

WASAC

NAME	POSITION	SIGNATURE
Jesse NTAMUTUZANA	Head Technical Inspection Unit	13/12/2019
Uwumukiza Felicien	Standard & Quality Control Officer	

JAICA

NAME	POSITION	SIGNATURE
Vedaste NTANGISHAKA	Assistant NRW project	
Masanta MAYUSUMI	JICA expert	

CONTRACTOR

NAME	POSITION	SIGNATURE
TUYISHIME JEAN GLAMOUR	MANAGING DIRECTOR	

ADDITIONAL FITTINGS DURING INSTALLATION WORKS OF PRV,s & FV's

REVEILLEZ VOUS Ltd

KIGALI CITY
TEL : 0784638769
EMAIL : reveillezvous534@gmail.com
TIN : 111642389

INVOICE N°: 28

Date: 20/08/2020

INVOICE TO

TIN : -
Name : KYOWA ENGINEERINGCONSULTANT.CO,LTD

Item Code	Item Description	Qty	Tax	Unit Price	Total Price
RW2AMX4BX0000007	PVC Coupling 75mm	1	B	70,000.00	70,000.00
RW2AMX4BX0000004	PVC CONE REDUCTION 110/75mm	1	B	15,000.00	15,000.00
RW2AMX4BX0000005	Te equal DI DN150	1	B	150,000.00	150,000.00
RW2AMX4BX0000006	Conereduction DN150/80	1	B	120,000.00	120,000.00
RW2AMX4BX0000001	Cone reduction DN100/80	2	B	100,000.00	200,000.00
RW2AMX4BX0000002	QUICK ADACPTORS DI DN 100/80	2	B	100,000.00	200,000.00
RW2AMX4BX0000003	SOCKET JOINT DN200	1	B	8,000.00	8,000.00
RW2AMX4BX0000008	PVC Coupling90mm	3	B	85,000.00	255,000.00
RW2AMX4BX0000009	Alluminium ladder	1	B	350,000.00	350,000.00

SDC INFORMATION

Date: 20/08/2020 16:48:11
SDC ID : SDC007040449
RECEIPT NUMBER : 29/29 NS
Internal Data:Z3DD-E6RS-HWAJ-BX73-XPOZ-CF5F-3U
Receipt Signature:R67D-X35C-CRWZ-LA3Q

RECEIPT NUMBER:28
Date : 20/08/2020 16:48:11
MRC : WIS01023273

Total Rwf	1,368,000.00
Total A-EX Rwf	0.00
Total B-18% Rwf	1,368,000.00
Total Tax B Rwf	208,677.97
Total Tax Rwf	208,677.97

REVEILLEZ VOUS Ltd

KIGALI CITY
TEL : 0784638769
EMAIL : reveillezvous534@gmail.com
TIN : 111642389

INVOICE N°: 29

Date: 20/08/2020

INVOICE TO

TIN : -
Name : KYOWA ENGINEERINGCONSULTANT.CO,LTD

Item Code	Item Description	Qty	Tax	Unit Price	Total Price
RW2AMX4BX0000009	QUICK ADACPTORS DI DN 80	2	B	65,000.00	130,000.00
RW2AMX4BX0000008	FLANGED GATE VALVE DN	3	B	180,000.00	540,000.00
RW2AMX4BX0000003	FLANGED GATE VALVE DN 80	2	B	150,000.00	300,000.00

SDC INFORMATION

Date: 20/08/2020 16:47:23
SDC ID : SDC007040449
RECEIPT NUMBER : 28/28 NS
Internal Data:ET6U-6MK2-REYC-CYU5-DIP5-6YDU-TQ
Receipt Signature:IMYS-HRQA-NXX4-T43E

RECEIPT NUMBER:29
Date : 20/08/2020 16:47:23
MRC : WIS01023273

Total Rwf	970,000.00
Total A-EX Rwf	0.00
Total B-18% Rwf	970,000.00
Total Tax B Rwf	147,966.10
Total Tax Rwf	147,966.10

REVEILLEZ VOUS Ltd

KIGALI CITY
TEL : 0784638769
EMAIL : reveillezvous534@gmail.com
TIN : 111642389

INVOICE N°: 32

Date: 20/08/2020

INVOICE TO

TIN : -
Name : KYOWA ENGINEERINGCONSULTANT.CO,LTD

Item Code	Item Description	Qty	Tax	Unit Price	Total Price
RW2AMX4BX0000003	BULO	16	B	2,000.00	32,000.00
RW2AMX4BX0000008	BULO	16	B	3,500.00	56,000.00
RW2AMX4BX0000009	GET VALVE	1	B	250,000.00	250,000.00
RW2AMX4BX0000001	ADAPTER DI DN150	2	B	100,000.00	200,000.00

SDC INFORMATION

Date: 20/08/2020 18:02:58
SDC ID : SDC007040449
RECEIPT NUMBER : 32/32 NS
Internal Data:QIEA-TYLZ-DSU6-VFOY-6QN4-QDL7-64
Receipt Signature:TWQR-2B4L-EB7D-SQGT

RECEIPT NUMBER:32
Date : 20/08/2020 18:02:58
MRC : WIS01023273

Total Rwf	538,000.00
Total A-EX Rwf	0.00
Total B-18% Rwf	538,000.00
Total Tax B Rwf	82,067.79
Total Tax Rwf	82,067.79

3. Water Level Meter

4.Water Level Meter

No	Item	Quantity	Unit Price	Total Price all taxes (JPY)
1	Water Level Meter	3	223,300	669,900

INVOICE (Water Level Meter)

領　収　証

No. 14222

KYOWA ENGINEERING CONSULTANTS CO., LTD.

株式会社 十勝和コンサルタント 様

令和 2 年 6 月 10 日

¥669,900※

Total Amount 669,900 JPY (tax included)

200円

但 商品代金 609,000 消費税 60900

上記の金額正に領収致しました TAMAPod AQUA 2-3台

振込		669	900
小切手			
手形			
相殺			

タマヤ計測システム株式会社
〒140-0013 東京都品川区南大井 6-13-7
TEL.03-5764-5561(代) FAX-03-5764-5565

Datalogger for Water Level Sensor

TAMAPod AQUA-2
Instruction Manual

Rev. 1.3

TAMAYA TECHNICS INC.
3-7, Minami-Oi 6-Chome
Shinagawa-ku, Tokyo 140-0013
Japan

TEL: +81-3-5764-5561
FAX: +81-3-5764-5565
URL: http://www.tamaya-technics.com

Updated on March 3, 2020

Thank you for choosing TAMAPod AQUA-2, the datalogger for water level sensor. Please read through this instruction manual carefully before use, and use it correctly. Also, when you have read the manual, please keep it safely and refer to it whenever necessary.

Table of Contents

Cautions and Requests:

① Contents in the Package

If any of the four items below happens to be missing, please contact the local agent from whom you have purchased the AQUA-2.

☐AQUA-2 Datalogger·····1 unit

☐SD card·····1 set

☐AA-size alkaline dry cell·2 pcs

☐Instruction manual·····1 copy

LCD Display, Simple and Easy Operation with Only 2 Keys

Simple operation with only 2 keys: Select／Enter

Handy Features Like Water Level Offset and LCD Display

With the water level offset feature, the AQUA-2 can be installed in accordance with conditions and environment at the site of installation.
Also, setting of water level offset, the (monitored) current water level , and recorded values can be checked, easily, on the LCD display.

■ Automatically transfer data to SD memory card

The data information will be automatically transferred without key operation.

If you insert SD memory data in the data logger, the internal data is automatically transferred to SD memory card, once internal data filled.

■ Three years continuous monitoring is possible by AA size Alkaline dry cell

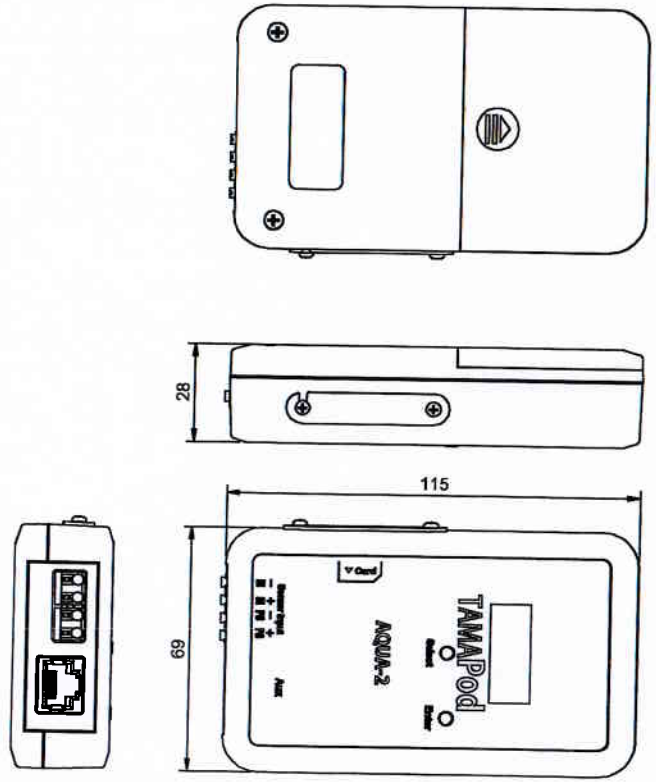
Saving power consumption enable this data logger to measure three years measuring time by AA-size dry cell.

※Measurement time : 10 minutes

LCD display indicate level of battery capacity, so you can easy to find the time to replace of battery.

■Dimensional Outline Drawing

■Dimensional Outline Drawing



■ Internal memory

Maximum data to record in internal card is 28,000 data.
Maximum recording time for each interval is s below.

Measurement interval	Recoding capacity of internal memory	Size of CSV file
1 mn	Approx.19 days	930KB
10min	Approx.194 days	
1 hour	Approx. 1,167 days	

■Data capacity and battery life during SD memory card inserted

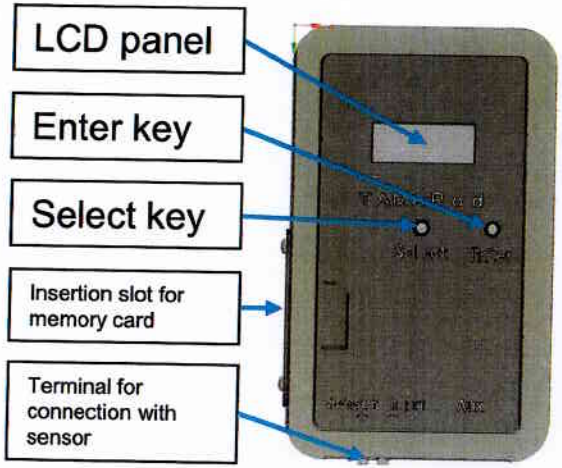
Almost unlimited recording is enabled by automatically transfer internal data to inserted SD card.
Chart of recording capacity and recording time is as below.

Measurement interval	Recording time	Number of files / Size
1 mn	Up to 15 months	24 files / Approx. 22 MB
10min	Up to 36 months	6 files / Approx. 6 MB
1 hour	Up to 42 months	2 files / Approx. 2MB

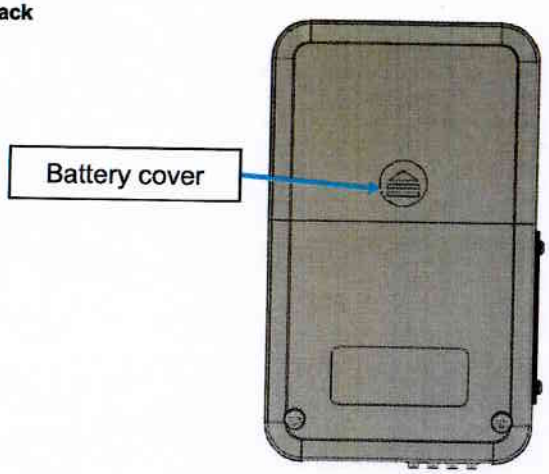
※ In the case of using bland-new alkaline dry cell.

■ Physical Description

■Front



■Back



Measurement start immediately once battery is inserted.
Measurement stop by removing battery.

(1) Slide battery cover with slightly pushing red circled part.

(2) Insert AA-size Alkaline dry cells carefully about polarity.

(3) Close battery cover.

⚠ Cautions

※ Make sure you use dry cells (2 of AA-size alkaline dry cells) with the AQUA-2.
※ When replacing dry cells, make sure you replace two of the same AA-size alkaline dry cells, made by the same manufacturer, at the same time.
※ Follow the cautions mentioned on the dry cells, when using the AQUA-2.
※ Insert the batteries, correctly, making sure the polarity is right.
※ A rechargeable battery, such as a nickel cadmium or a nickel metal hydride battery, cannot be used.

■Checking Recorded Data

The AQUA-2 records data by means of Comma Separated Values (CSV) files. Thus, it is possible to edit data using applications such as Microsoft Excel.
Remove the memory card from the AQUA-2, and use a card reader to read recorded data as a file on a PC.
Folder of data transferred month and year is automatically created. Recorded data files are created in the folder.

A file name is comprised the model name (two letters), its serial number (six letters), under bar, date of file created (six letters), under bar and time of create of file created (six letters).

例)A2170901_170915_121314.csv

Model name
Serial number
Year, month, date of created file
Hour, minute, second of created file

```
Date,Time,Water, Batt
2017/09/09,11:40:00,-123.45,03.0
2017/09/09,11:50:00, +123.45,03.0
2017/09/09,12:00:00, -123.45,02.9
2017/09/09,12:10:00, -123.45,12.0
```

Header

Recorded data
"Date, time, water level (m), and battery voltage (V)"

■Start of CSV file transfer

If you measure with SD memory card inserted, CSV file will be automatically transferred to SD memory card once internal memory is filled.

■ Data transfer

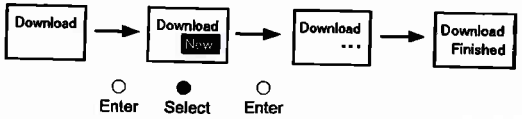
When data is transferred from internal memory to SD memory card, internal data is not automatically deleted.

It has two modes of data transfer from internal memory.
"New" mode, internal data that have been never transferred before will be transferred.
"All" mode, all data in internal memory will be transferred.

(1) Press "Select". and show "Download", then press "Enter".

(2) Blinking "New" or "All". Select by "Select" and press "Enter".

(3) Blinking "Wait" and displayed transfer indicator.
Once display "Finished", data transfer finished normally.



Error message of data transfer is as below.

Download No Data	There is any data to transfer. Internal memory is empty, or it might be displayed at the time to start data transfer.
Download No Card	SD memory card is not inserted.
Download Protect	SD memory card is protected. Check SD memory card.
Download Card Err	SD memory card can not be read. Possibly format of SD memory card is incorrect, or data is damaged.
Download Batt Low	Battery voltage is low. Replace battery and try again.

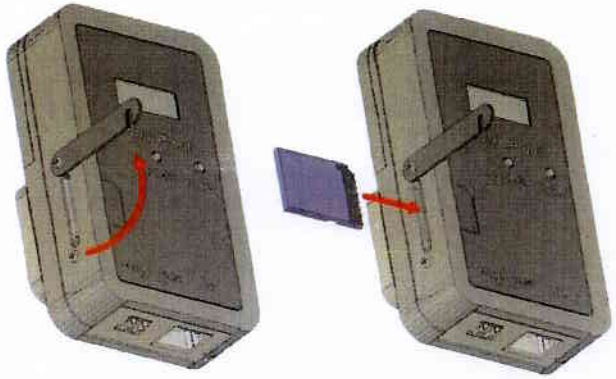
● Memory card

The memory cards which can be used with the AQUA-2 are SD memory card and MMC (multi media card).

Open the cover for memory card, in the direction of the arrow, and insert a memory card, as in the drawing below.
The memory card should be pushed in until a click sound is heard. Once the memory card is inserted all the way, close the cover for the memory card, again.

If the memory card is inserted correctly, it is locked and will not come loose. When removing the memory card, push it further into the AQUA-2, and the locking device will be released, allowing you to pull the card out again.

The maximum capacity of a memory card, which can be used with the AQUA-2, is 32GB(FAT16/32).

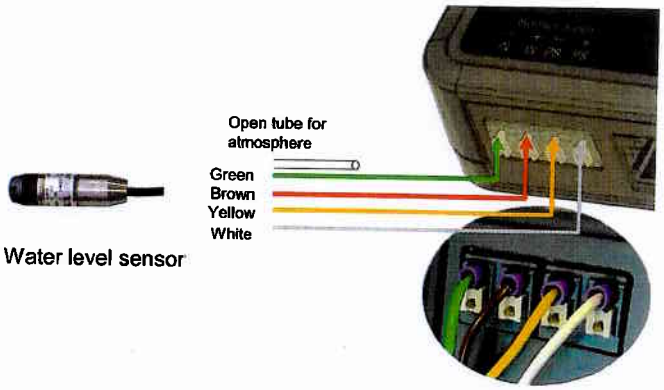


※The locking device for the memory card is of "alternate type".
※Be careful not to insert or remove the memory card with excessive force. Using excessive force may cause damages on the datalogger.
※When removing the memory card, wait for at least 1 second after the last input of data, before removing the card.
※Immediately after data input, the memory card will be overwritten. If the memory card is removed while it is being overwritten, data files inside the card may be damaged.

■ Method of Connecting with Sensors

The AQUA-2 is designed to work with pressure sensors. Below is an example of AQUA-2's connection with a typical, standard water level sensor.

Example: Connection with Tamaya's standard water level sensor



Terminal Block Symbol	Color of Cable	Content
+PS	White	Power supply for sensor, plus
-PS	Yellow	Power supply for sensor, minus
+IN	Brown	Signal, plus
-IN	Green	Signal, minus

(1) Connect cables to upper hole of white notch with pushing the notch. When you remove cables, also with pushing the notch.

(2) Sink Water level sensor in water. Then confirm LCD display show "Monitor" and measured water level.

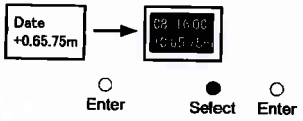
※Data of LCD display is updated once every second.

■Checking Recorded Data

(1) Press "Select" to display "Data" and then press "Enter".

(2) Press "Select" to back to previously recorded data.

(3) Press "Enter" finish checking.



■Indication of Battery Voltage

The indicator of battery voltage shows the amount of battery voltage remaining.
※Display of remaining battery is based on the voltage of battery.

BATT [■■■] : 3.0V or more

BATT [■■] [_■■] : 2.2V or more

BATT [■] [__■] : 2.0 V or more : Replace battery.

BATT [ ] [_____] : 1.8V or less : Replace battery. Data cannot be overwritten on SD card.

■Checking and Changing Time

(1) Once you have "Time" displayed, press "Enter". Once you get the figure for the hour blinking, press "Select" key to change the figure and press "Enter" to confirm.
(2) Then the figure for the minute starts blinking. Use "Select" key to change the figure, and press "Enter" to confirm.
(3) Then the figure for the second starts blinking. Use "Select" key to change the figure, and press "Enter" to confirm.
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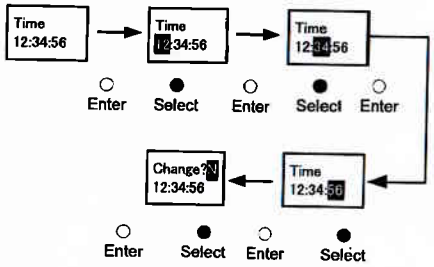
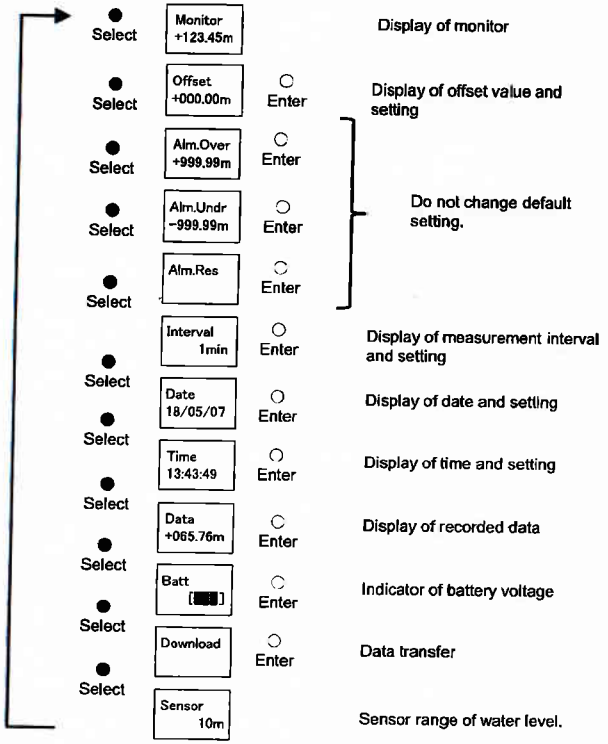


② Operation Menus

When the AQUA-2 is not in use, its LCD display is switched OFF, to save power. Display will appear on LCD when any of the following three keys – Select and Enter – is pressed.

Operation menus will change from one to another in the sequence below. When activating the operation menu currently on display, press the "Enter" key. If you wish to go to the next operation menu, press the "Select" key.

Also, the AQUA-2 has a backlight feature, allowing the user to read the display even in the dark.



■Monitoring Input

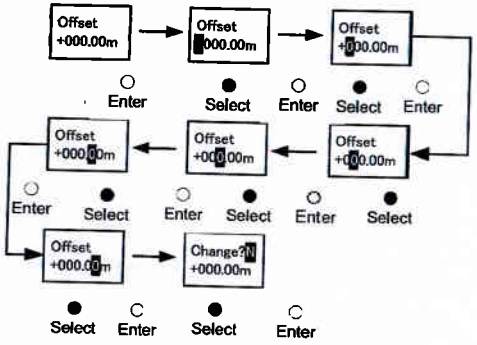
When LCD display off, touch any key to show " Monitor ", and current water level. Data is updated once every second.
90 seconds past after last key operation, display automatically turns off.

Current water level is displayed
Data is updated once every second.

■Setting and Changing Water Level Offset Values

(1) Once you have "Offset" displayed, press "Enter".
(2) When changing a water level offset value, you can change the value of the digit of your choice. Press "Enter" until you reach the digit of your choice.
(3) Use the "Select" key to set the value of your choice.
(4) When the message "Change?" Y, N" is displayed, use the "Select" key to select "Y" or "N", and press "Enter" key to confirm

※The range of offset values that can be set is dependent on the measurement range and the smallest unit of display of the water level sensor.

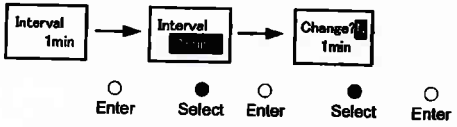


■Checking and Changing Measurement Intervals

(1) Once you have "Interval" displayed, press "Enter".

(2) Once you get the number blinking, press "Select" key to find the interval you wish to set.

(3) When the message "Change?" Y, N" is displayed, use the "Select" key to select "Y" or "N", and press "Enter" key to confirm.



■Checking and Changing Dates

(1) Once you have "Date" displayed, press "Enter". Once you get the figure for the year blinking, use "Select" key to change the figure and press "Enter" to confirm.
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Datalogger for Water Level Sensor

TAMAPod AQUA-2
Instruction Manual

Rev. 1.3

TAMAYA TECHNICS INC.
3-7, Minami-Oi 6-Chome
Shinagawa-ku, Tokyo 140-0013
Japan

TEL:+81-3-5764-5561
FAX: +81-3-5764-5565
URL: http://www.tamaya-technics.com

Updated on March 3, 2020

Thank you for choosing TAMAPod AQUA-2, the datalogger for water level sensor. Please read through this instruction manual carefully before use, and use it correctly. Also, when you have read the manual, please keep it safely and refer to it whenever necessary.

Table of Contents

Cautions and Requests:

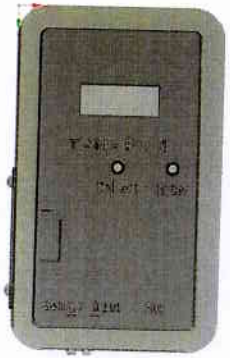
※ All the technical data and information contained herein are subject to change without prior notice.

※ Please contact our local agent if you are not clear with any of the materials supplied in this instruction manual.

※ Tamaya Technics Inc. shall not be liable for any damages or losses to you as a result of using the information or material on this instruction manual.

① Contents in the Package

If any of the four items below happens to be missing, please contact the local agent from whom you have purchased the AQUA-2.



☐AQUA-2 Datalogger·····1 unit

☐SD card·····1 set

☐AA-size alkaline dry cell·2 pcs

☐Instruction manual·····1 copy

② Special Features

LCD Display, Simple and Easy Operation with Only 2 Keys

Simple operation with only 2 keys: Select／Enter

Handy Features Like Water Level Offset and LCD Display

With the water level offset feature, the AQUA-2 can be installed in accordance with conditions and environment at the site of installation.
Also, setting of water level offset, the (monitored) current water level , and recorded values can be checked, easily, on the LCD display.

■ Automatically transfer data to SD memory card

The data information will be automatically transferred without key operation.

If you insert SD memory data in the data logger, the internal data is automatically transferred to SD memory card, once internal data filled.

■ Three years continuous monitoring is possible by AA size Alkaline dry cell

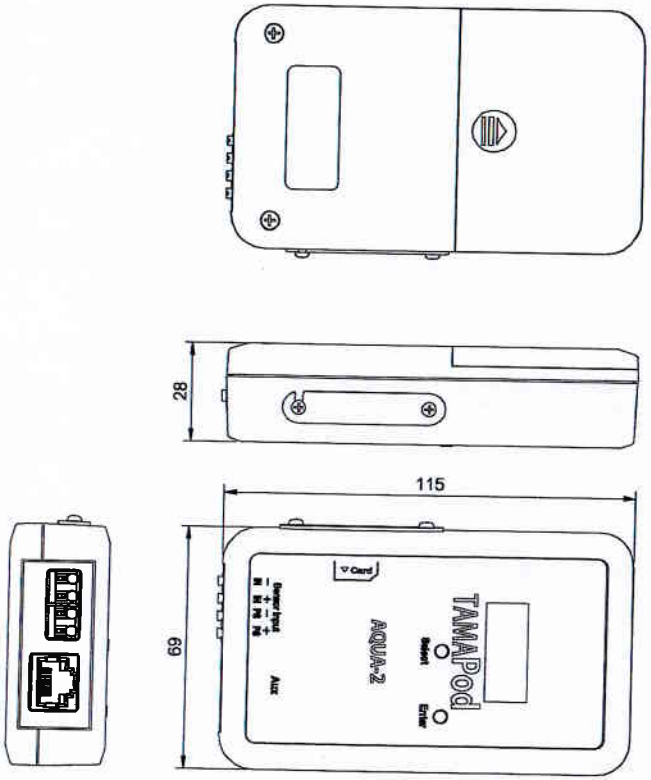
Saving power consumption enable this data logger to measure three years measuring time by AA-size dry cell.

※Measurement time : 10 minutes

LCD display indicate level of battery capacity, so you can easy to find the time to replace of battery.

⑩ Dimensional Outline Drawing

■Dimensional Outline Drawing



⑨ Data capacity and Battery life

■ Internal memory

Maximum data to record in internal card is 28,000 data.
Maximum recording time for each interval is s below.

Measurement interval	Recoding capacity of internal memory	Size of CSV file
1 mn	Approx.19 days	930KB
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Almost unlimited recording is enabled by automatically transfer internal data to inserted SD card.
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※ In the case of using bland-new alkaline dry cell.

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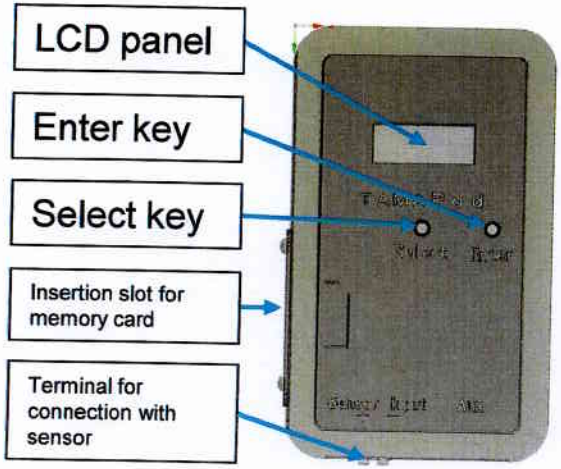
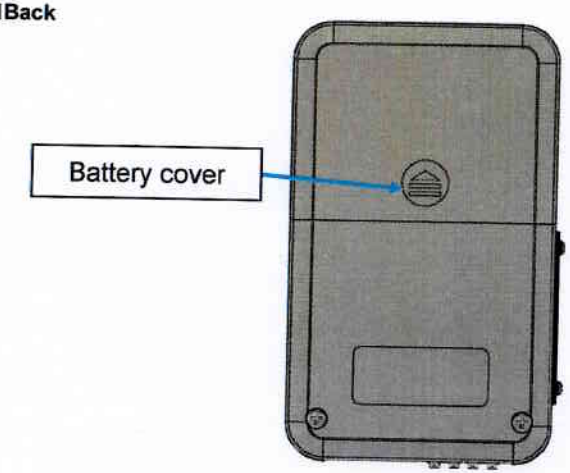


■Back



④ Procedures for Inserting (and replacing) Batteries

Measurement start immediately once battery is inserted.
Measurement stop by removing battery.

(1) Slide battery cover with slightly pushing red circled part.

(2) Insert AA-size Alkaline dry cells carefully about polarity.

(3) Close battery cover.

⚠ Cautions

※ Make sure you use dry cells (2 of AA-size alkaline dry cells) with the AQUA-2.
※ When replacing dry cells, make sure you replace two of the same AA-size alkaline dry cells, made by the same manufacturer, at the same time.
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⑧ Measurement Method

■Checking Recorded Data

The AQUA-2 records data by means of Comma Separated Values (CSV) files. Thus, it is possible to edit data using applications such as Microsoft Excel.
Remove the memory card from the AQUA-2, and use a card reader to read recorded data as a file on a PC.
Folder of data transferred month and year is automatically created. Recorded data files are created in the folder.

A file name is comprised the model name (two letters), its serial number (six letters), under bar, date of file created (six letters), under bar and time of create of file created (six letters).

例) A2170901_170915_121314.csv

- Model name
- Serial number
- Year, month, date of created file
- Hour, minute, second of created file

```
Date,Time,Water, Batt
2017/09/09,11:40:00,-123.45,03.0
2017/09/09,11:50:00, +123.45,03.0
2017/09/09,12:00:00, -123.45,02.9
2017/09/09,12:10:00, -123.45,12.0
```

Header

Recorded data
"Date, time, water level (m), and battery voltage (V)"

■Start of CSV file transfer

If you measure with SD memory card inserted, CSV file will be automatically transferred to SD memory card once internal memory is filled.

⑦ Operation Menus

■Checking and Changing Time

(1) Once you have "Time" displayed, press "Enter". Once you get the figure for the hour blinking, press "Select" key to change the figure and press "Enter" to confirm.
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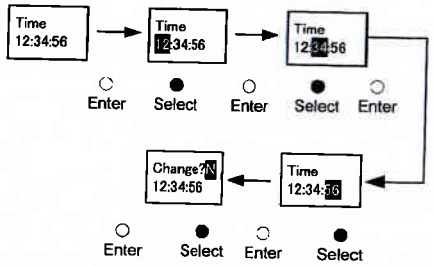

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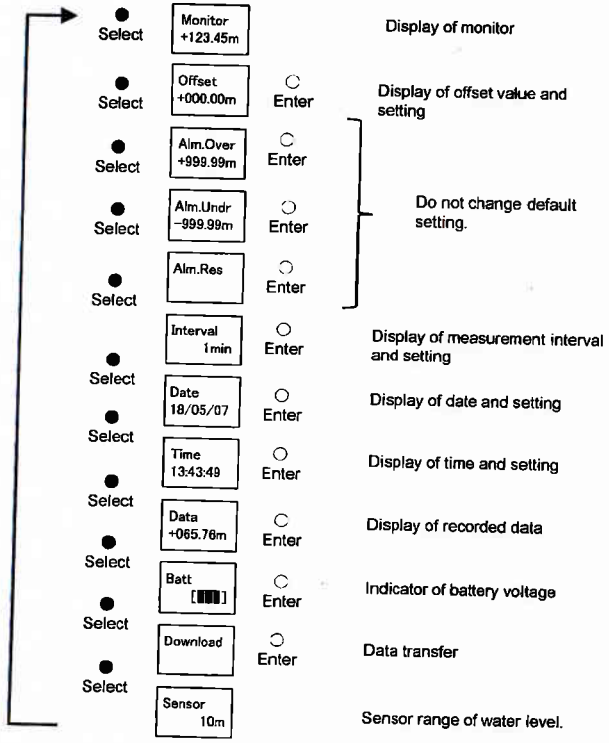

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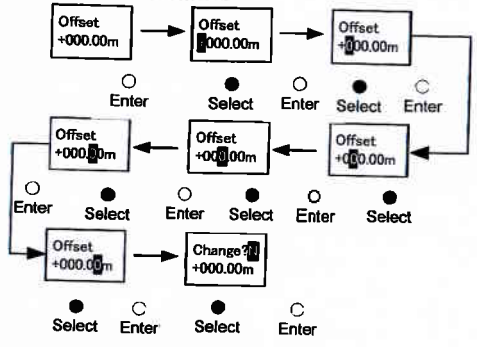

⑦ Operation Menus

■Checking and Changing Measurement Intervals

(1) Once you have "Interval" displayed, press "Enter".

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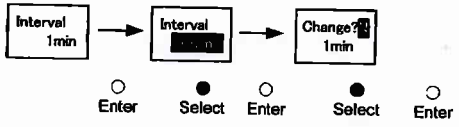
(3) When the message "Change?" Y, N" is displayed, use the "Select" key to select "Y" or "N", and press "Enter" key to confirm.



■Checking and Changing Dates

(1) Once you have "Date" displayed, press "Enter". Once you get the figure for the year blinking, use "Select" key to change the figure and press "Enter" to confirm.
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4. Water Pressure Meter

5.Water Pressure Meter

No	Item	Quantity	Unit Price	Total Price all taxes (JPY)
1	Pressure sensor	3	33,193	99,578
2	Logger	3	46,750	140,250
3	Data Collector	3	42,900	128,700
				368,528

INVOICE (Water Pressure Meter)
領収証

No. 00000023　　2020年 5月19日

KYOWA ENGINEERING CONSULTANTS CO.,LTD.

株式会社協和コンサルタンツ　国際事業部　様

金額
¥368,528－

Total Amount 368,528 JPY (tax included)

但

上記正に領収いたしました

内
消費税等

現金			

192-0046 東京都八王子市明神町3-20-6
八王子フォーストラックエア 11F
株式会社 センシズ
TEL 042-660-0091 FAX 042-660-0093

係 小澤

HLV • HLI

Features **1.Compact** **2.Welded structure**

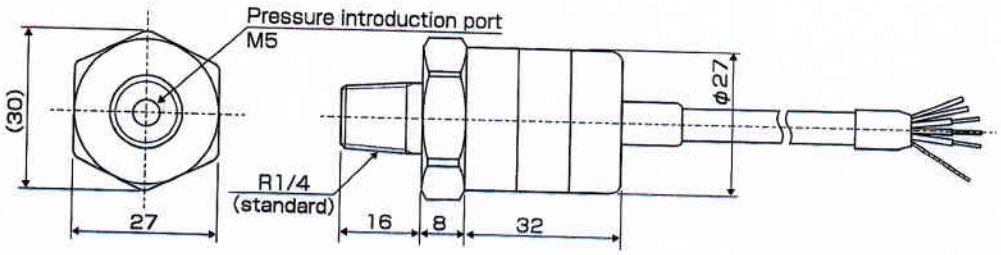
- Pressure sensor with a welded structure that does not use an O-ring in the wetted part
- The wetted part is made of SUS316 or SUS316L that has high corrosion resistance.
- Support of a wide range of pressure media such as gas and medicinal solution
- Output signal of 1 to 5 VDC or 4 to 20 mADC from a built-in amplifier circuit

Specifications

Model	HLV・HLI									
	N-100KP	-020KP	-050KP	-100KP	-300KP	-500KP	-001MP	-002MP	-003MP	-005MP
Rated pressure ※1	0 to −100kPa	0 to 20kPa	0 to 50kPa	0 to 100kPa	0 to 300kPa	0 to 500kPa	0 to 1MPa	0 to 2MPa	0 to 3MPa	0 to 5MPa
Pressure type	Gauge pressure ※2									Shield gauge pressure
Overpressure	HLV : 200% of the rated pressure ／ HLI : 150% of the rated pressure									
Wetted part material	Diaphragm : SUS316L Pressure port : SUS316									
Sealing liquid	Silicone oil									
Applicable media	Gas and fluid (media not damaging the wetted part material)									
Power supply	12 to 28VDC									
Output	HLV : 1 to 5VDC ／ HLI : 4 to 20mADC									
Current consumption	HLV : 6mA or less									
Load resistance	HLV : 1k Ω or more ／ HLI : 600 Ω or less (at power of 24 VDC)									
Responsiveness	5msec or less									
Accuracy (linearity)	± 0.5% F.S. or less ※3 (± 0.3% F.S. or less)									
Temperature characteristics	± 0.05% F.S. ／℃ or less (0 to 60℃)									
Compensated temperature range	0 to 60℃									
Operating temperature range	− 20 to 80℃ (no freezing allowed)									
(Measurement medium temperature)	− 20 to 100℃ (no freezing allowed)									
Operating humidity range	35 to 85% RH (no dew condensation allowed)									
Pressure connection port	R1/4 (standard) ・ R3/8 ・ R1/2 ・ G1/4 ・ G3/8									
Cable	φ6 vinyl : 500mm ／ 2000mm (standard) Shield cable + atmospheric relief pipe (Excluding -003MP and -005MP)									
Structure	IP65									
Insulation resistance	100M Ω or more ／ 500VDC									
Withstand voltage	500VAC, 1 minute									
Vibration resistance	98.1m ／ s², 2 hours (X, Y, and Z directions)									
Weight	Approx 200g									
Impact of mounting orientation (port orientation changed from downward to sideways)	+ 0.1% F.S.	+ 0.5% F.S.	+ 0.3% F.S.	+ 0.1% F.S.						

※1.We also manufacture compound pressure sensors (gauge pressure of 500 kPa or less).
※2.Make sure that the operating vacuum pressure is 10 kPa abs or more. (Operating temperature range: 0 - 60℃)
※3.We also manufacture high-accuracy pressure sensors (accuracy: ± 0.25% F.S. or less).

Dimensions (Units : mm)



Cables / wires

	HLV	HLI
Red	Power supply +	Power supply +
White	Output	Power supply −
Black	Common	—
Atmospheric relief pipe	Gauge pressure available	

Model

HL VC - 500 KP - 02 - R3

- **Type**
- **Output mode** — **V** : Voltage, **I** : Current
- **Special** — **Space** : Positive pressure, **N** : Negative pressure, **C** : Compound pressure
- **Pressure range**
- **Unit of pressure** — **KP** : kPa, **MP** : MPa
- **Cable length** — **Space** : 0.5m, **02** : 2m, **05** : 5m, **10** : 10m
- **Pressure connection port** — **Space** : R1/4 (standard), **R3** : R3/8, **R4** : R1/2, **G2** : G1/4, **G3** : G3/8

LR5041
LR5042
LR5043

HIOKI

Instruction Manual

VOLTAGE LOGGER

EN

Feb. 2019 Revised edition 4
LR5041B980-04 19-02H

6003291745

Settings Chapter 3

Configure measurement settings before starting to record.
Logger settings can also be made from a PC running the LR5000 Utility Program. (p.36)

3.1 Settings List

Following is a list of all settings.
Although all settings are available from the LR5000 Utility Program, some settings are limited when made from the logger.

Setting Item	Setting Options	Logger	Refer To	LR5000 Utility Program	Refer To
Recording Interval	Sets the recording interval.	Yes	(p.31)	Yes	(p.39)
Current Date and Time	Set the current year, month, day, hour, and minute. (The LR5000 Utility Program can set the logger's clock to match the computer's.)	Yes	(p.32)	Yes	(p.42)
Stop Method	Select the processing method when memory becomes full.	Yes	(p.33)	Yes	Included in the recording stop method
Recording Mode	Selects instantaneous or statistical value recording (measurements are taken once per second, and instantaneous, maximum, minimum, and average values are saved at each recording interval).	Yes	(p.34)	Yes	(p.39)
Power Save	Battery life is extended when on (enabled).	Yes	(p.34)	Yes	(p.38)
Preheat Time	Select the ON time for external sensor power control.	Yes	(p.35)	Yes	(p.40)
Model Comment	Enter a comment for the specified logger.	No	-	Yes	(p.38)
Channel Comment	Enter a comment for the specified measurement channel.	No	-	Yes	(p.38)
Recording Start Method	Select the recording start method. (The start time can be specified.)	No	-	Yes	(p.39)

Setting Item	Setting Options	Logger	Refer To	LR5000 Utility Program	Refer To
Recording Stop Method	Select the recording stop method. (The stop time can be specified.)	No	-	Yes	(p.39)
Scaling	Use to scale measured values to display as adjusted values.	No	-	Yes	(p.40)
Alarm Thresholds	Set upper and lower threshold values to display the alarm indicator [AL] on the logger.	No	-	Yes	(p.41)

Specifications Chapter 8

8.1 Measurement Specifications

Input	DC voltage (1 channel)
Input impedance	LR5041: 4 MΩ±10% LR5042: 2.2 MΩ±10% LR5043: 2 MΩ±10%
Measurement ranges	±50.00 mV (LR5041) ±5.000 V (LR5042) ±50.00 V (LR5043) "UF" or "OF" indicates out-of-range measurement
Measurement accuracy	±0.5%rdg. ±5dgt.
Accuracy guarantee for temperature and humidity	• Temperature: 23°C±5°C (73°F±9°F) • Humidity: 80%RH or less (non-condensating)
Temperature coefficient	Measurement accuracy × 0.05/°C Note: Add to measurement accuracy when outside of the range 23°C±5°C (73°F±9°F)
Guaranteed accuracy period	1 year
Product warranty period	3 years
Maximum ratings	Max. rated voltage between terminals: ±60 mV (LR5041), ±6 V (LR5042), ±60 V (LR5043) Max. rated voltage to ground: 60 V DC

8.2 Functional Specifications

Display type	LCD
Display contents	Measured value, units (mV, V), recording (REC), endless recording (ENDLESS), statistical recording (STAT), recording interval (INTVL), pre-heat time (PrE.H), date and time (TIME), alarm (AL), battery status, recorded data count (DATA), maximum value (MAX), minimum value (MIN), auto power saving (APS)
Operation button	Four ("SET", "REC/STOP", "+", "-")
Recording interval	1/2/5/10/15/20/30 sec., 1/2/5/10/15/20/30/60 min.
Recording modes	• Instantaneous recording: The instantaneous value is recorded at each recording interval • Statistical recording: Measurements are taken once per second, and instantaneous, maximum, minimum, and average values are saved at each recording interval (cannot be selected when the recording interval is set to one second).
Recording capacity	• Instantaneous recording: 60,000 values • Statistical recording: 15,000 instantaneous, maximum, minimum, and average values
Recording start method	• Logger button operation • Instant or scheduled time (set by computer/Data Collector)
Recording stop method	• Logger button operation (endless recording) • Logger button operation (one-time recording) • Scheduled time (endless recording) • Scheduled time (one-time recording) Scheduled time is set by computer/Data Collector
Retained recording sessions	Two sessions (each from recording start to stop)
Alarm	Indicates when measured values are outside of the range defined by upper and lower thresholds set from a computer or the Data Collector
Scaling	Scales and displays measured values according to settings made from a computer or the Data Collector (measurement units are not displayed for scaled values)
Preheat output	OFF/0.5/1/2/5/10/30/60 sec.
Power save setting	The measurement data display turns off about 30 seconds after the last button operation (cancel power save for continuous display)
Real-time clock	Provided

8.3 Miscellaneous

Clock accuracy	±50ppm (@25°C (@77°F)) ±4.32 s/day
Backup	Recorded data and settings (independent of battery)
Interface	Half-duplex start/stop synchronous infrared serial communication between the logger and Communication Adapter or Data Collector
Power supply	• Rated supply voltage: 1.5 V DC • One AA-size alkaline battery (LR6) • Recording and clock operation, and maximum and minimum values are retained for about 30 seconds during battery replacement
Maximum rated power	0.1 VA
Battery life	• Approx. 2 year (instantaneous recording, with 1-minute recording interval and auto power saving, @20°C (@68°F)) • Approx. 2 month (with 1-second recording interval, @20°C (@68°F))
Dimensions	Approx. 79W×57H×28D mm (3.11"W×2.24"H×1.10"D)
Mass	Approx. 105 g (3.7 oz.) (w/battery)
Dust and water protection rating	IP54 (EN60529) (with connection cable connected, but not including cable tip)
Accessories	• LR6 alkaline battery ..... 1 (Internal in the logger) • LR9802 Connection Cable ..... 1 • Instruction Manual..... 1 • Operation Manual..... 1 • Stand..... 1
Options	• LR5091 Communication Adapter • LR5092-20 Data Collector • LR9802 Connection Cable • LR9901 Wall-Mounted Holder • Z5004 Magnetic Strap
Environmental conditions	• Operating environment: indoors, pollution degree 2, up to 2000 m ASL • Operating temperature and humidity: -20°C to 70°C (-68°F to 158°F), 80%RH or less (non-condensating) • Storage temperature and humidity: -20°C to 70°C (-68°F to 158°F), 80%RH or less (non-condensating)
Applicable Standards	• Safety: EN61010 • EMC : EN61326

8.4 LR5091 Communication Adapter Specifications

Main Unit General Specifications

Functions	Converts between the logger's infrared signals and USB signals to support communications between the logger and a computer (USB port).
Compatible loggers	LR5001 Humidity Logger, LR5011 Temperature Logger, LR5031 Instrumentation Logger, LR5041, LR5042, LR5043 Voltage Logger, LR5051 Clamp Logger Note: Communication with models LR5031 is supported by PC Utility version 1.05 and later. LR5051 is supported by PC Utility version 1.01 and later.
Operating temperature and humidity	Temperature: 0°C to 40°C (32°F to 104°F), Humidity: 80%RH or less (non-condensating)
Storage temperature and humidity	Temperature: -10°C to 50°C (14°F to 122°F), Humidity: 80%RH or less (non-condensating)
Operating environment	Indoors, pollution degree 2, up to 2000 m ASL
Power supply	DC5 V (USB bus-powered)
Maximum rated power	0.5 VA
Dimensions	Approx. 83W×61H×19D mm (3.27"W×2.40"H×0.75"D) (without projections)
Mass	Approx. 43 g (1.5 oz.) (without USB cable)
Applicable Standards	• Safety: EN61010 • EMC : EN61326
Product warranty period	3 years

USB standard	USB 2.0 compliant, Full Speed support
Connector	Mini B series receptacle
Connectable device	Computer
Communication speed	115,200bps

Communication method	Half-duplex start/stop synchronous infrared serial communication
Communication speed	115,200bps

Accessories

USB cable (1 m)	1
LR5000 Utility Program (CD)	1

Supplied LR5000 Utility Program Specifications

Supplied medium	CD.....1
Operating environment	Personal computer meeting the following specifications • CPU: 1 GHz or faster processor clock • RAM: at least 512 MB • Operating system: Windows XP SP2 or later, Windows Vista® SP1 or later, or Windows 7 • Runtime library: .NET Framework 2.0/3.5 • Interface: USB (or COM port for models 3910, 3911, or 9612) • Monitor resolution: 1024 x 768 or higher • Hard disk: At least 30 MB free space (Another 500 MB may be required if .NET Framework 2.0 or 3.5 is not yet installed. Additional space is required for storing recorded data.)
Model communication support	All LR5000-series loggers Note1: Communication with models LR5031 is supported by PC Utility version 1.05 and later. LR5051 is supported by PC Utility version 1.01 and later. Note2: The COMMUNICATION UTILITY program supports the following models' settings and data import functions. A computer COM port and 9612 RS-232C cable are required when using the model 3910 or 3911 Communication Base. • All "Data Logger" models 363x to 364x • Communication Base models 3910, 3911, and 3912
Communication connections	Communication with LR5000-series loggers: • Computer, USB cable, LR5091 Communication Adapter, and LR5000-series logger • Computer, USB cable, LR5092-20 Data Collector, and LR5000-series logger Communication with the LR5092-20 Data Collector: Computer, USB cable, and LR5092-20 Data Collector
Setting functions	• Export/import settings by communication with the LR5000 series • Settings exported from each LR5000 are stored on the computer (the following functions are supported by the supplied PC Utility version 2.00, or later) • Export/import settings by communication using the LR5092-20 Data Collector • Import and save logger settings using the LR5092-20 Data Collector via communication or SD memory card • Settings exported to the LR5092-20 Data Collector are stored on the computer
Auto-start function	A small resident program (icon in the task tray/notification area) detects when a logger or the Data Collector is connected to the computer, and automatically starts the LR5000 Utility Program.

Data import functions	• Communicates with the LR5000-series loggers, and imports recorded data • Combines recorded data • Incorporates new data when an LR5000-series logger holds data not previously imported (the following functions are supported by the supplied PC Utility version 2.00, or later) • Communicates with the LR5092-20 Data Collector, and imports recorded data saved in the Data Collector • Imports data saved to an SD memory card in the LR5092-20 Data Collector
Graph display functions	• Displays up to 16 channels in a graph • Displays up to 16 Y-axes • Displays one time base axis • Set line colors for each channel, and display/hide lines and bar graphs for each channel • Auto setting of time base and vertical axis • Display/hide Y-axis grid lines, and set grid display density • Select display background color • Copy graph images to the clipboard • A/B cursor functions • Displays statistical data (maximum, minimum, and average)
Data list display functions	• Browse recorded data in tabular format • Displays up to 600 channels • Displays statistical data (maximum, minimum, and average)
Export functions	• Export all recorded data displayed in a table in CSV format • Paste to Excel® all recorded data displayed in a data table • Export all recorded data between A/B cursors in CSV format • Paste to Excel® all recorded data between A/B cursors
Import functions	Import text files from the 3169 Clamp-On Power HiTester Note: Only electric energy data recorded at one-second or longer interval can be imported
Printing functions	• Prints graphs and statistical data • Supports A3, A4, and B4 paper sizes
Data processing functions	Scaling (y=a×x+b), electric power calculation, energy cost calculation, operating rate calculation, integration, dew-point temperature calculation, arithmetic calculations, out-of-range data revision
File management functions	• Copy and delete data saved on the computer (the following functions are supported by the supplied PC Utility version 2.00, or later) • Delete data saved to an SD memory card in the LR5092-20 Data Collector
Help function	Displays helpful operating instructions

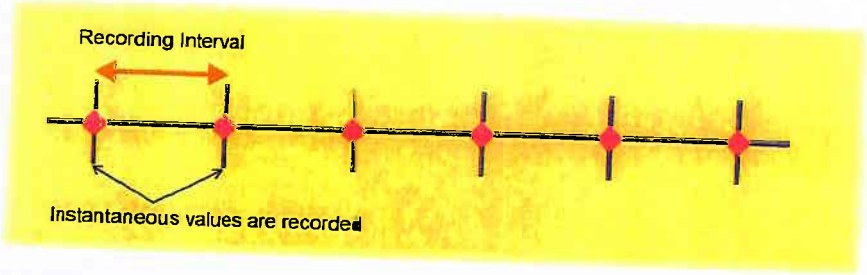
Appendix

Appendix 1 About Recording Modes

The recording method depends on the selected recording mode. The recording modes are as follows.

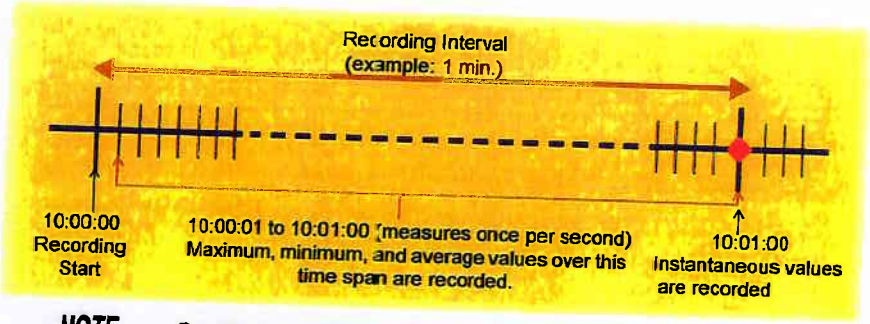
Instantaneous Recording

Measurements are recorded in internal memory at each recording interval.



Statistical Recording

Measurements are taken once per second, and instantaneous, maximum, minimum, and average values are saved to internal memory at each recording interval. Data at the recording start time is not recorded (in the following case, data at 10:00:00 is not recorded).



NOTE Statistical recording cannot be selected when the recording interval is set to one second.

Appendix 2 Recording Intervals and Maximum Recording Times

The recording time is calculated according to the recording capacity.

NOTE The maximum recording time is limited by the remaining battery capacity.

Instantaneous Recording

Up to 60,000 values can be recorded.

Recording Interval	Recording Time	Recording Interval	Recording Time
1 sec.	16 h, 40 min	1 min	41 d, 16 h
2 sec.	1 d, 9 h, 20 min	2 min	83 d, 8 h
5 sec.	3 d, 11 h, 20 min	5 min	208 d, 8 h
10 sec.	6 d, 22 h, 40 min	10 min	416 d, 16 h
15 sec.	10 d, 10 h	15 min	625 d
20 sec.	13 d, 21 h, 20 min	20 min	833 d, 8 h
30 sec.	20 d, 20 h	30 min	1250 d
		60 min	2500 d

Statistical Recording

Up to 15,000 values can be recorded.

Recording Interval	Recording Time	Recording Interval	Recording Time
1 sec. (Cannot be set)	-	1 min	10 d, 10 h
2 sec.	8 h, 20 min	2 min	20 d, 20 h
5 sec.	20 h, 50 min	5 min	52 d, 2 h
10 sec.	1 d, 17 h, 40 min	10 min	104 d, 4 h
15 sec.	2 d, 14 h, 30 min	15 min	156 d, 6 h
20 sec.	3 d, 11 h, 20 min	20 min	208 d, 8 h
30 sec.	5 d, 5 h	30 min	312 d, 12 h
		60 min	625 d

Appendix 3 Battery Life Approximation

Battery life depends on the recording interval.
The following table shows battery life when power saving (p.34) is enabled. Battery life is approximately two months when power saving is disabled or when the statistical recording mode is enabled.

Recording Interval	Battery Life	Recording Interval	Battery Life
1 sec.	Approx. 60 days	30 sec.	Approx. 1.5 year
10 sec.	Approx. 1 year	1 min or more	Approx. 2 year

ANNEXES DOCUMENTS

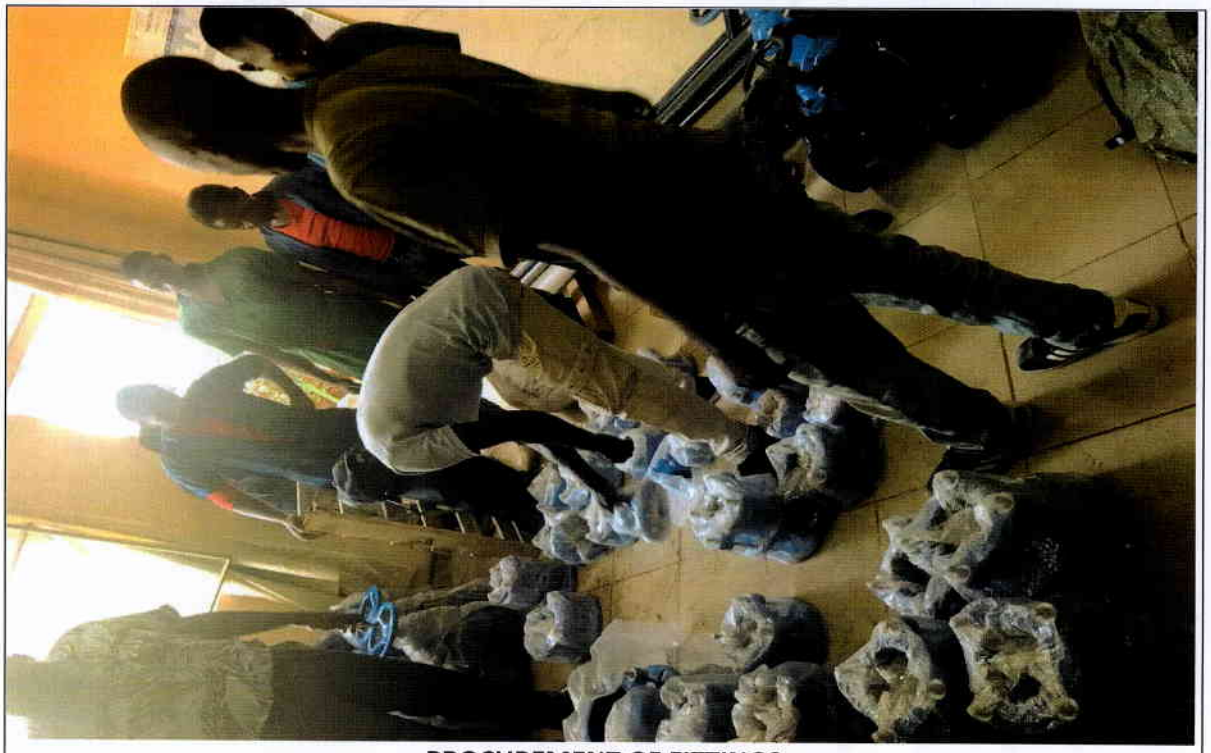
✓ **PROCUREMENT PHOTOS**

1. FVs , FVs & Fittings

FLOAT VALVES AND VALVES INSTALLED (PHOTOS)

FLOAT VALVES AND VALVES AT KIMISAGARA WTP, BEFORE INSTALLATION

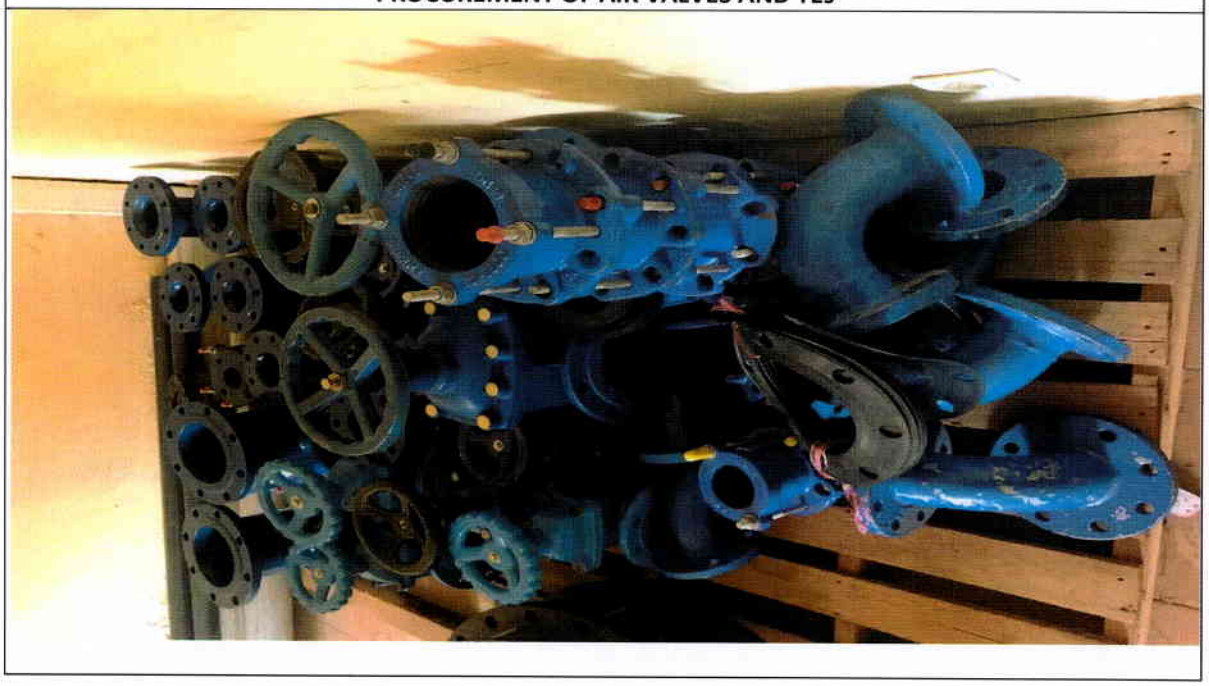
REHABILITATION & MODIFICATION OF FITTINGS



PROCUREMENT OF FITTINGS

PROCUREMENT OF GATE VALVES

PROCUREMENT OF AIR VALVES AND TEs



PRESSURE REDUCTION VALVES

ANNEX DOCUMENT

- ✓ **INSTALLATION PHOTOS**

1. PRVs & fittings installations

THE PRESSURE REDUCTION VALVES AND FITTINGS INSTALLED (PHOTOS)

PRV & FITTINGS AT KABIZOZA II / NYARUGENGE

PRV & FITTINGS AT GATSATA / NYARUGENGE

PRV & FITTINGS AT ABANYAMAKURU / GIKONDO BRANCH

PRV & FITTINGS AT KABIZOZA I / NYARUGENGE BRANCH

PRV & FITTINGS AT RWARUTABURA / NYAMIRAMBO BRANCH

PRV & FITTINGS AT NATIOANAL II / NYARUGENGE BRANCH

PRV & FITTINGS AT RWAMPARA / NYAMIRAMBO BRANCH

PRV & FITTINGS AT NYACYONGA / GIKONDO BRANCH

ANNEX DOCUMENT

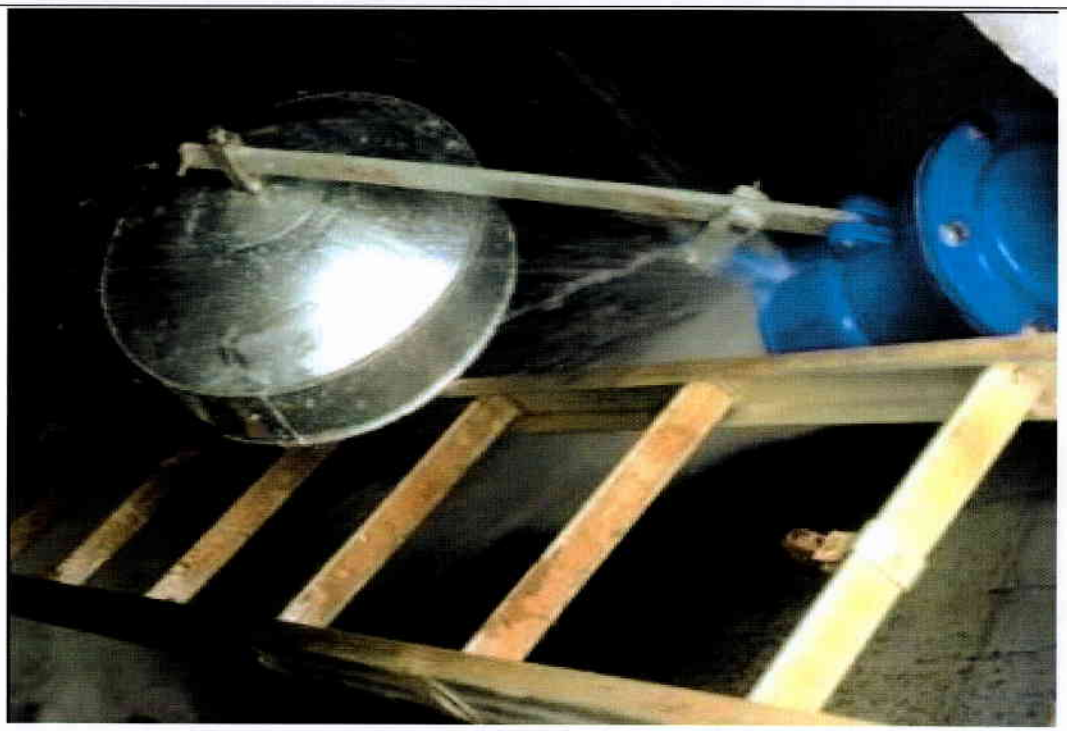
- ✓ **INSTALLATION PHOTOS**

2. FVs & valves replacements

FV installed at Mwendo – Rwesero / Nyamirambo branch

FV at Kibagabaga / Remera branch

FV AT MURAMBI / GIKONDO BRANCH



FV AT AYABARAYA / KANOMBE BRANCH

AYABARAYA RESERVOIR REINSTALLATION WORK / KANOMBE BRANCH

GACURIRO RESERVOIRS, THE VALVES REPLACEMENTS

GIKONDO PRIMARY SCHOOL VALVES REPLACEMENTS

INSTALLATION TEAM

FV AT CHEZ LANDO RESERVOIR / REMERA BRANCH

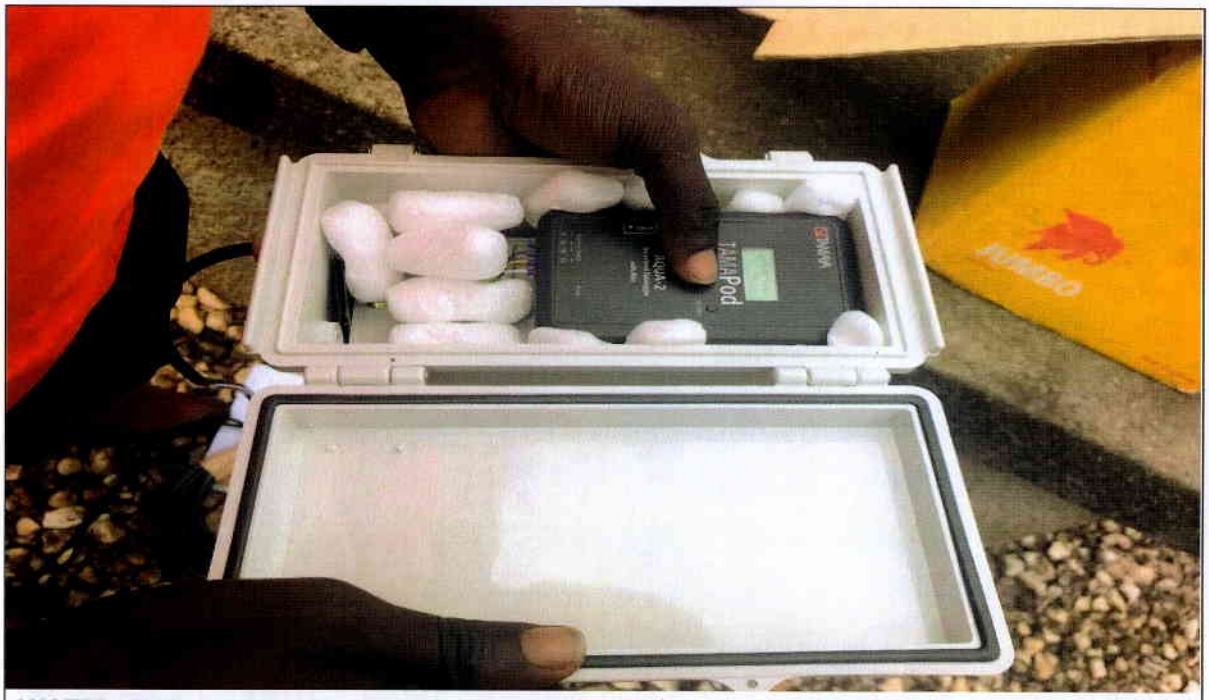
ANNEX DOCUMENT

- ✓ **WATER LEVEL METER PHOTOS**

WATER LEVEL METER

WATER LEVEL METER FOR FLOAT VALVE ASSESSMENT AT MWENDO - RWESERO

WATER LEVEL METER FOR FLOAT VALVE ASSESSMENT AT GACURIRO



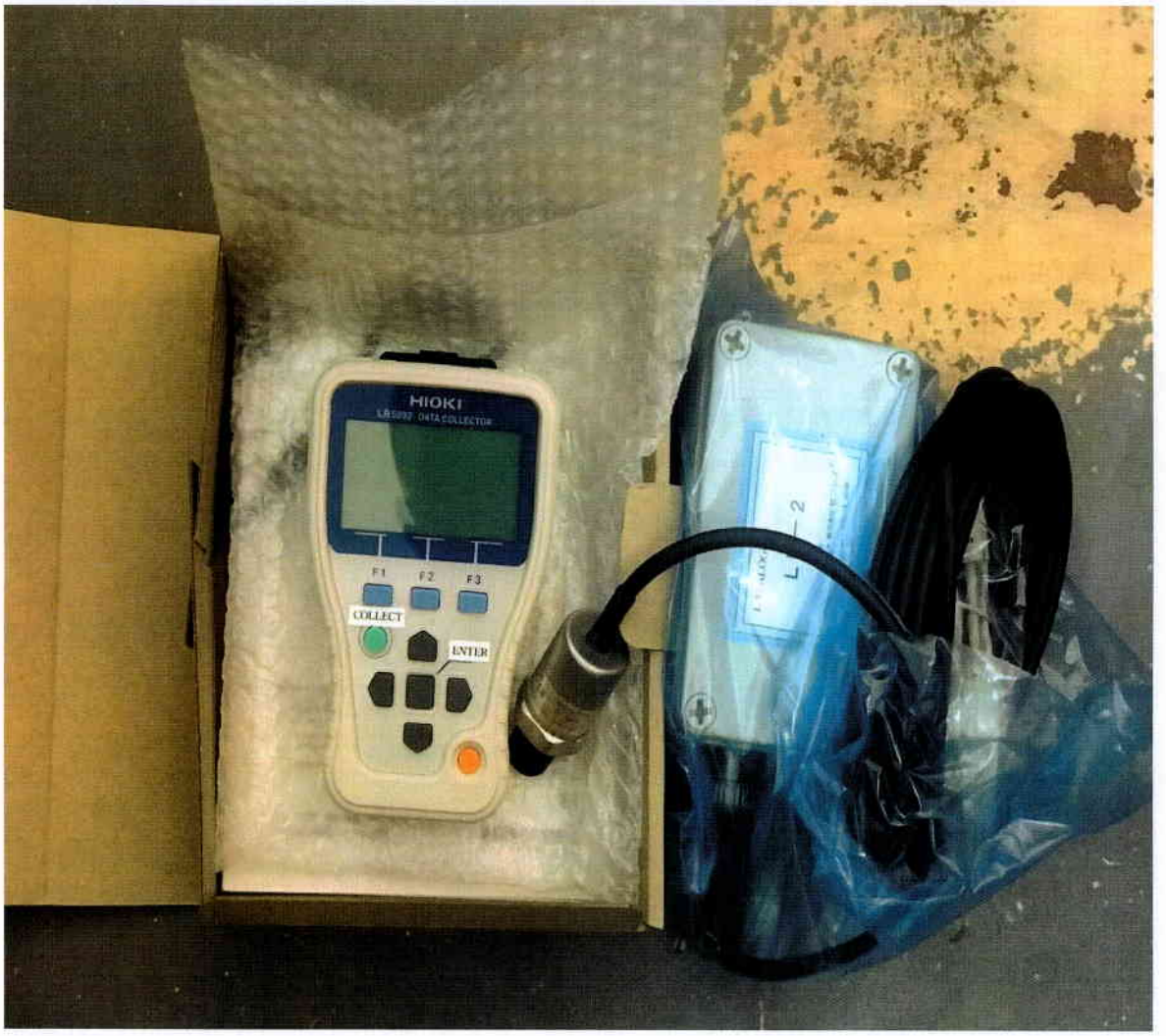
WATER LEVEL METER FOR FLOAT VALVE ASSESSMENT AT KIBAGABAGA

WATER LEVEL METER

ANNEX DOCUMENT

- ✓ **WATER PRESSURE METER PHOTOS**

WATER PRESSURE METERS



HIOKI
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ENTER

レター④

WASAC
Water & Sanitation Corporation

"Dignifying Life"

Kigali, 19 NOV 2021
Ref.No 3477/ /2021/DUWSS/dn

Mr. MARUO Shin
Chief Representative
JICA Rwanda Office

Re: Receipt of Equipment from JICA

Equipment for Support to WASAC Strategic Response to COVID-19 within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

We are pleased to inform you that we have received the equipment from JICA in the project for "Strengthening Non-Revenue Water Control in Kigali City Water Network" based on record of discussion signed on March 30, 2016 and Minutes of Meeting concerning COVID-19 Response signed on July 22 between WASAC and JICA.
The received equipment are for;

1. Portable Engine Pump and Bulk Water Meter 23 sets for Water Transportation Work of Emergency Water Supply for People who have Limited Access to Clean Water
2. Equipment and Materials of Pipe and Fittings for Network Leakage Repair ,1 lot
3. Equipment and Materials of Distribution and Service Pipe for Replacement, 1 lot
4. Foat Valves, 12 Flanged Gate Valves including all related accessories 1 lot and
5. Photocopy Machine, 1 Unit

Sincerely,

Gisele UMUHUMUZA
Acting Chief Executive Officer

Copy to:

- **Director of Urban Water and Sanitation Services**
- **Director of Support Services**

Attachment:

- List of Equipment and Materials

"Dignifying Life"

INTERNAL MEMO

From: Director of Urban Water and Sewerage Services

To: Director of Support Service.

Date: 26th October 2021

Re: Receipt of Equipment from JICA to WASAC Main Store.

Dear Sir,

We are pleased to inform you that we have received the equipment from JICA in the project for **"Strengthening Non-Revenue Water Control in Kigali City Water Network to Support in Strategic Response to COVID-19"** based on the Minute of Meeting signed July 22nd, 2020 between WASAC and JICA.

Received Equipment and Materials are as follows:

- 23 sets of Portable Engine Pumps and Bulk Meters.
-Pipe and Fittings for Network Leakage Repair to reduce Intermittent Water Supply.
-Distribution and Old Service Pipe Replacement in Ruyenzi Area (Nyarugenge Branch).
- 15 Float Valves, 12 Flanged Gate Valves including all related accessories and
- 1 Photocopy Machine

We would like to request your authorization to allow above said equipment and materials entering in WASAC Oracle System before distributing them to the users.

Sincerely,

Methode RUTAGUNGIRA
Director of Urban Water and Sewerage Services

Attachment:
-List of Equipment and Materials.

KYOWA ENGINEERING CONSULTANTS CO.,LTD.
Address: KEC Bldg., 1-62-11, Sasazuka, Shibuya-ku, Tokyo Japan, 151-0073
TEL: (03)3376-3178 FAX: (03)3320-6542

October 21, 2021

To: Ms. Gisele Umuhumuza
Acting Chief Executive Officer
WASAC

Re: Handover of the Equipment for Support to WASAC Strategic Response to COVID-19 within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

Dear Sir,

With reference to the Record of Discussions signed on March 30, 2016 and Minutes of Meeting concerning COVID-19 Response signed on July 22, 2020 between WASAC and JICA, we would like to hand over the following equipment listed as attached.

We humbly request WASAC to utilize them properly and maintain them in good condition.

1. Portable Engine Pump and Bulk Water Meter 23 sets for Water Transportation Work of Emergency Water Supply for People who have Limited Access to Clean Water
2. Equipment and Materials of Pipe and Fittings for Network Leakage Repair and Piping Work Tools for Reduction of Intermittent Water Supply (Item 1), 1 lot
3. Equipment and Materials of Distribution and Service Pipe for Replacement for Reduction of Intermittent Water Supply (Item 2), 1 lot
4. Equipment and Materials of Float Valve for Reduction of Intermittent Water Supply (Item 3), 1 lot
5. Photocopy Machine, 1 Unit

Sincerely,

For **Shigeo OTANI**
Chief Adviser, JICA Expert Team
Kyowa Engineering Consultants Co., Ltd.

Attachment:

- List of Equipment and Materials
- Inspection record

CC:

- Director of Urban Water and Sanitation Services, WASAC Ltd.
- Director of Support Services, WASAC Ltd.

1. Portable Engine Pump and Bulk Meters

DELIVERY NOTES OF MATERIALS FROM JICA TO WASAC LTD

Procurement of Equipment and Materials for Temporal Water Tanks with its Stand and Subcontract with Water Tanker Owners, Lot 2 the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

Date: 20/101/2021

No	Item	DN	Specification	Quantity	Unit Price (RWF)	Price (RWF)
1	Engine pump		Market: HONDA Made in: THAILAND Type: Self-priming centrifugal pump DN 80mm Fuel type: Gasoline Starting system: Manual Max. delivery volume: more than 55 m3/hr Total head: more than 20m Net weight: les than 30kg	23	1,055,600	24,278,800
2	Water supply hose	DN 80mm×10 m for suction	PVC suction hose of pump (for Drinking water) with Outside threaded on one side (nipple connection)	23	115,000	2,645,000
3	Water supply hose	DN 80mm×20 m for discharge	PVC discharge hose of pump (for Drinking water) with Inside threaded on one side (union connection)	23	80,000	1,840,000
4	Bulk Water Meter	DN 50	Market: ZENNER Made in: GERMAN Type: Woltman turbine meter (Horizontal turbine shaft: WPH) Diameter Nominal: DN50mm Size of meter (acc. To EEC) Qn: 15 Nominal Pressure: PN16 EEC Metrological class : B Hermetically sealed register:IP68 Structure: Cast-iron Body, Epoxy coating Document:Instruction manual, Product	23	642,400	14,775,200
Total without VAT (RWF)						**43,539,000**
VAT (RWF)						**7,837,020**
Total with VAT (RWF)						**51,376,020**

Total with VAT (US Dollar)	**52,310**

PREPARED BY:

MR. VEDASTE ITANGISHAKA
Assistant NRW Project
WASAC / JICA

APPROUVED BY

MR. TSUTSUI NOBUYUKI

JICA EXPERT TEAM
JAPAN

MR. METHODE RUTAGUNGIRA

DIRECTOR OF PROJECT AND URBAN WATER & SEWARAGE SERVICES

INSPECTION RECORD

Procurement of Equipment and Materials for Temporal Water Tanks with its Stand and Subcontract with Water Tanker Owners, Lot 2, the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

Date: 03/12/2020

No	Item	DN	Specification	Quantity	Quantity received	Comments
1	Engine pump		Type: Self-priming centrifugal pump DN 80mm Fuel type: Gasoline Starting system: Manual Max. delivery volume: more than 55 m3/hr Total head: more than 20m Net weight: les than 30kg Recommended product (refer to attached catalogue): Excalibur, Honda, another product also will be acceptable	23	23	Received with all accessories needed to be connected to Truck Tankers and Tanks at sites. (Adaptas and Rings)
2	Water supply hose	DN 80mm×10m for suction	PVC suction hose of pump (for Drinking water)	23	23	Received
3	Water supply hose	DN 80mm×20m for discharge	PVC discharge hose of pump (for Drinking water)	23	23	Received
4	Bulk Water Meter	DN 50	Type: Woltman turbine meter (Horizontal turbine shaft: WPH) Diameter Nominal: DN50mm Size of meter (acc. To EEC) Qn: 15 Nominal Pressure: PN16 EEC Metrological class : B Hermetically sealed register:IP68 Structure: Cast-iron Body, Epoxy coating Recommended product (refer to attached catalogue): BERMAD, INVENSYS, METRIMA,RUBIN, SENSUS, ZENNER	23	23	Received.

MEMBERS

DATE: 03/12/2020

WASAC

NAMES	FUNCTION	SIGNATURE
UWUMUREMYI Felicien	Standard & quality Control officer	
MUGABO J. MV	Leak detection and pressure mgt Operator	

JICA

NAMES	FUNCTION	SIGNATURE
Vedaste ITANGISHAKA	Assistant NRW Project	

CONTRACTOR

NAMES	FUNCTION	SIGNATURE
Fredwald Nahimana	Managing Director	

ETS NAFOLD
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KIGALI - RWANDA

ETS NAFOLD

B.P. 2961 KIGALI
Phone: + 250 788527031
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E-mail: nafold2005@gmail.com
KIGALI-RWANDA

Form-1

Quotation of the Work

Date: 09/10/2020

To : Kyowa Engineering Consultants Co., Ltd.

Tender for : Procurement of Equipment and Materials for Temporal Water Tanks with its Stand and Subcontract with Water Tanker Owners, Lot 2, for the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

We, the undersigned, having carefully examined the Price Competition Documents, hereby submit the Quotation in accordance with all provisions and conditions as described in the Price Competition Documents.

1. Quotation Price: We offer the quotation price (with VAT) as mentioned below:

Total : **52,310 US Dollar**

Fifty Two Thousand Three Hundred Ten US Dollars

2. Validity of Quotation

This Quotation is valid until November 15, 2020.

Froduald NAHIMANA
Managing Director
Ets NAFOLD

ETS NAFOLD
TEL: 0788527031 B.P. 2961
KIGALI-RWANDA

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KIGALI-RWANDA

Form-2

Amendment Breakdown of the Quotation, and Specification

Procurement of Equipment and Materials for Temporal Water Tanks with its Stand and Subcontract with Water Tanker Owners, Lot 2,
the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network

No	Item	DN	Specification	Quantity	Unit Price (RWF)	Price (RWF)
1	Engine pump		**Marque: HONDA** **Made in THAILAND** **Model: Wh30 XT** **Type**: Self-priming centrifugal pump DN 80mm Fuel type: Gasoline Starting system: Manual Max. delivery volume: more than 55 m3/hr Total head: more than 20m Net weight: les than 30kg Document: Instruction Manual, Product Warranty	23	1,055,600	24,278,800
2	Water supply hose	DN 80mm×10m for suction	PVC suction hose of pump (for Drinking water) with outside threaded on one side (nippe connection) refer to attachment.	23	115,000	2,645,000
3	Water supply hose	DN 80mm×20m for discharge	PVC discharge hose of pump (for Drinking water) with inside threaded on one side (union connection) refer to attachment	23	80,000	1,840,000
4	Bulk Water Meter	DN 50	**Mark: ZENNER** **Made in GERMAN** Type Woltman turbine meter (Horizontal turbine shaft: WPH) Diameter Nominal: DN50mm Size of meter (acc. To EEC) Qn: 15 Nominal Pressure: PN16 EEC Metrological class : B Hermetically sealed register IP68 Structure: Cast-iron Body, Epoxy coating Document:Instruction manual, Product warranty, Accuracy inspection report	23	642,400	14,775,200
Total without VAT (RWF)						43,539,000
VAT (RWF)						7,837,020
Total with VAT (RWF)						**51,376,020**

Total with VAT (US Dollar)	**52,310**

Done at Kigali on 09/10/2020
Froduald NAHIMANA
Managing Director
Ets NAFOLD

ETS NAFOLD
TEL: 078852703 B.P. 2961
KIGALI-RWANDA

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	G015564410W0	Install position:	H	Batch No.:	20191122739
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420000314	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/22 12:52	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.01 MPa	Nominal size:	DN50
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.912	104.22	22.1	692.233	768.3	1454	685.700	-0.944	-0.94	13.75	
0.407	1777.85	22.9	200.863	1485.5	1688.6	203.100	1.114	1.11		
0.270	672.42	22.9	50.394	1690	1740.5	50.500	0.210	0.21		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	G015564410W0	Install position:	H	Batch No.:	20191122737
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国Mi	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420000325	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/22 10:56	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium: Water	Pressure: 0.02 MPa	Nominal size: DN50	
Appearance: ok	Pressure test: ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.788	103.55	21.7	684.255	250	931	681.000	-0.476	-0.48	13.75	
0.409	1766.25	22.3	200.805	957	1160	203.000	1.093	1.09		
0.271	670.49	22.4	50.398	1163.5	1214	50.500	0.202	0.20		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	G016507410W0	Install position:	H	Batch No.:	20191202101
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420005947	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/12/2 12:03	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PT8010	Inspector:	836

Medium:	Water		Pressure:	0.01 MPa			Nominal size:	DN50		
Appearance:	ok		Pressure test:	ok						
Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.364	104.90	18.6	680.809	1453.3	2134.6	681.300	0.072	0.07	13.75	
0.424	1704.32	19.3	200.695	2144.7	2346.8	202.100	0.700	0.70		
0.260	698.44	19.4	50.355	2348.4	2398	49.600	-1.499	-1.50		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	G016521910W1	Install position:	H	Batch No.:	20191124800
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006144	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/24 23:35	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.02 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
24.489	100.93	21.8	686.574	741.5	1424.7	683.200	-0.491	-0.49	13.75	
0.407	1774.59	22.2	200.820	1430.5	1633.4	202.900	1.036	1.04		
0.264	688.13	22.3	50.407	1634.5	1684.5	50.000	-0.807	-0.81		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125802
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006152	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 1:45	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.02 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.955	102.19	22.0	679.992	954.2	1633.5	679.300	-0.102	-0.10	13.75	
0.411	1760.30	22.5	200.804	1639	1842.5	203.500	1.343	1.34		
0.262	693.93	22.6	50.420	1845	1895.5	50.500	0.159	0.16		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125803
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006154	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 2:42	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.02 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.090	106.05	22.0	680.193	183.1	859.2	676.100	-0.602	-0.60	13.75	
0.409	1765.81	22.4	200.779	865.5	1068.5	203.000	1.106	1.11		
0.265	684.72	22.4	50.428	1070.4	1121	50.600	0.341	0.34		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All time counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125803
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50 M	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006155	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 2:42	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium: Water	Pressure: 0.02 MPa	Nominal size: DN100	
Appearance: ok	Pressure test: ok		

Flow rate (m3/h)	Test time (s)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.089	106.05	21.9	680.177	362.9	1041.2	678.300	-0.276	-0.28	13.75	
0.409	1765.81	22.3	200.775	1407	1608.3	201.300	0.261	0.26		
0.265	684.72	22.3	50.427	239	289	50.000	-0.847	-0.85		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125804
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006158	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 3:43	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.02 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.622	104.34	21.7	684.655	228.8	906.8	678.000	-0.972	-0.97	13.75	
0.414	1748.87	22.0	200.881	912.4	1114.3	201.900	0.507	0.51		
0.257	705.44	22.1	50.374	1116.2	1166	49.800	-1.139	-1.14		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125805
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006160	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 4:42	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.02 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.554	104.21	21.7	681.850	26.3	703.5	677.200	-0.682	-0.68	13.75	
0.428	1691.04	22.1	200.826	713.6	917.5	203.900	1.531	1.53		
0.268	677.99	22.1	50.394	919.4	969.5	50.100	-0.583	-0.58		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125811
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006167	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 11:49	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.02 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.959	103.21	21.9	686.891	995.1	1680	684.900	-0.290	-0.29	13.75	
0.409	1769.38	22.5	200.874	685.7	884.8	199.100	-0.883	-0.88		
0.258	704.32	22.5	50.409	887.7	936.2	48.500	-3.787	-3.79		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125812
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006168	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 12:48	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.01 MPa
Appearance:	ok	Pressure test:	ok
		Nominal size:	DN100

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.723	102.91	21.7	678.143	2265.5	2940	674.500	-0.537	-0.54	13.75	
0.411	1758.82	21.9	200.777	2945	3144.5	199.500	-0.636	-0.64		
0.260	698.05	21.8	50.401	3145.7	3195	49.300	-2.184	-2.18		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
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ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125808
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop e
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006175	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 8:38	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.01 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.779	103.37	21.9	682.782	278.6	959.5	680.900	-0.276	-0.28	13.75	
0.408	1774.12	22.4	200.830	966.1	1169	202.900	1.031	1.03		
0.270	671.33	22.4	50.368	1170.5	1220.5	50.000	-0.731	-0.73		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
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ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125807
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006179	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 6:49	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.03 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.954	102.84	21.7	684.255	117.5	803	685.500	0.182	0.18	13.75	
0.411	1758.45	22.1	200.836	807.5	1007	199.500	-0.665	-0.67		
0.265	684.69	22.1	50.424	1006.5	1056.5	50.000	-0.841	-0.84		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125806
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006180	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 5:43	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.02 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.620	104.41	21.8	685.071	240	923.8	683.800	-0.186	-0.19	13.75	
0.408	1769.65	22.3	200.805	938.6	1140	201.400	0.296	0.30		
0.260	697.35	22.3	50.407	1144	1195	51.000	1.176	1.18		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125806
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006191	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 5:43	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.02 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.620	104.41	21.9	685.087	116.5	802.8	686.300	0.177	0.18	13.75	
0.409	1769.65	22.5	200.814	818.1	1020	201.900	0.541	0.54		
0.260	697.35	22.5	50.409	1024	1075.1	51.100	1.371	1.37		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125813
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006196	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 14:04	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.03 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
24.694	99.34	20.9	681.429	1129.4	1804.8	675.400	-0.885	-0.88	13.75	
0.417	1732.69	21.7	200.808	1809	2012	203.000	1.092	1.09		
0.267	679.44	21.7	50.410	2014.5	2065	50.500	0.179	0.18		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125813
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006197	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 14:04	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium: Water	Pressure: 0.03 MPa	Nominal size: DN100	
Appearance: ok	Pressure test: ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
24.692	99.34	20.7	681.400	3201.5	3884.3	682.800	0.205	0.21	13.75	
0.417	1732.69	21.4	200.794	3888.3	4090	201.700	0.451	0.45		
0.267	679.44	21.4	50.406	4094.2	4145	50.800	0.782	0.78		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125811
Q3:	25 m3/h	Ratio:	100	Test method:	Flying start/stop gra
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H5C	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006199	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 11:49	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium: Water	Pressure: 0.02 MPa	Nominal size: DN100	
Appearance: ok	Pressure test: ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value			Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Pulse	Indicate volume (l)	Error (%)			
24.147	103.21	21.8	686.875	0	692.300	0.790	0.79	13.75	
0.404	1769.38	22.3	200.865	0	198.400	-1.227	-1.23		
0.250	704.32	22.3	50.407	0	49.000	-2.791	-2.79		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125812
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国MI	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420006200	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 12:48	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium:	Water	Pressure:	0.01 MPa	Nominal size:	DN100
Appearance:	ok	Pressure test:	ok		

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.723	102.91	21.8	678.157	484.3	1162.6	678.300	0.021	0.02	13.75	
0.411	1758.82	22.1	200.786	1168.5	1370.4	201.900	0.555	0.55		
0.260	698.05	21.9	50.402	1372.4	1422.6	50.200	-0.401	-0.40		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125804
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国M	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420008561	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 3:43	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium: Water	Pressure: 0.02 MPa	Nominal size: DN50
Appearance: ok	Pressure test: ok	

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.622	104.34	21.7	684.655	228.8	906.8	678.000	-0.972	-0.97	13.75	
0.414	1748.87	22.0	200.881	912.4	1114.3	201.900	0.507	0.51		
0.257	705.44	22.1	50.374	1116.2	1166	49.800	-1.139	-1.14		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	U017720310W0	Install position:	H	Batch No.:	20191125813
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国M	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420009516	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/25 14:04	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium: Water	Pressure: 0.03 MPa	Nominal size: DN50
Appearance: ok	Pressure test: ok	

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
24.692	99.34	20.7	681.400	3201.5	3884.3	682.800	0.205	0.21	13.75	
0.417	1732.69	21.4	200.794	3888.3	4090	201.700	0.451	0.45		
0.267	679.44	21.4	50.406	4094.2	4145	50.800	0.782	0.78		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	G016507410W0	Install position:	H	Batch No.:	20191202101
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国M	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8420009581	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/12/2 12:03	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium: Water	Pressure: 0.01 MPa	Nominal size: DN50
Appearance: ok	Pressure test: ok	

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.364	104.90	18.6	680.809	1453.3	2134.6	681.300	0.072	0.07	13.75	
0.424	1704.32	19.3	200.695	2144.7	2346.8	202.100	0.700	0.70		
0.260	698.44	19.4	50.355	2348.4	2398	49.600	-1.499	-1.50		

Test spot for water meters by the company Zenner meters (Shanghai) Ltd.
15 Dongxing Road, Shanghai, 201613, Fon: +86-21-5774 4789, Fax: +86-21-57744790

ZENNER
All that counts.

Measure examination

Order-No:	G015564410W0	Install position:	H	Batch No.:	20191122738
Q3:	25 m3/h	Ratio:	100	Test method:	Standing start/stop g
SAP-No.:	151476	Description:	WPD-KN50-4HL200Q3-25R100H50VT50德国M	Test bench:	MSH.121.054
Manufacturer	ZENNER	Prod.-No.:	8ZRI8419159525	Accuracy class:	2
Room temperature(℃):	28	Date:	2019/11/22 11:51	Humidity(%RH):	70
Test Basis:	OIML R49	Registration-no:	DE-15-M1001-PTB010	Inspector:	836

Medium: Water	Pressure: 0.01 MPa	Nominal size: DN50
Appearance: ok	Pressure test: ok	

Flow rate (m3/h)	Test time (S)	Norm value		Indicate value				Average error (%)	Impulse value (Imp/l)	Repeatability (%)
		Temperature (℃)	Actual volume (l)	Initial (l)	Final (l)	Indicate volume (l)	Error (%)			
23.847	104.01	21.9	688.995	750	1436	686.000	-0.435	-0.43	13.75	
0.415	1742.72	22.5	200.824	1491	1692	201.000	0.088	0.09		
0.270	672.05	22.5	50.419	1697.8	1748.5	50.700	0.557	0.56		

ENGINE PUMPS DISRIBUTIONS LIST IN KACYIRU BRANCH

N0	ENGINE PUMP DESCRIPTION	LOCATION	PUBLIC TAP MANAGER (NAME & SIGNATURE)
1	HONDA WB 30 XT GCBRT-3155248	GASANZE 1	MUNYEMANA Déo c/o Agnes
2	GCBRT-3151302	GASANZE 2	SENGABO Emmanuel c/o MUREKATETE
3	GCBRT-3155256	GASANZE 3	MUKANDAHIRO Annia c/o IRADUKUNDA Diane
4	GCBRT-3155260	NDUBA 1	[illegible]
5	GCBRT-3155252	NDUBA 2	NDAGIRIJEMUNGU Théogène
6	GCBRT-3155253	NTORA	Mukashyaka Olive

WASAC TEAM

Kamana J.C Technician Op
Kacyiru Branch

JICA TEAM

Vedaste ITANGISHAKA
Assistant NRW project
WASAC - JICA

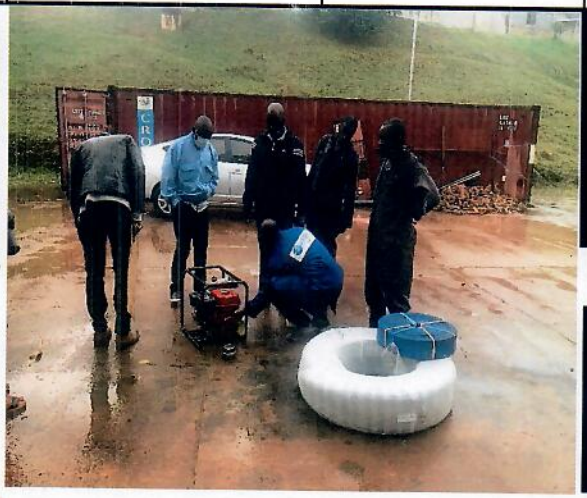
Mutabyejezu Jeanne

WATER AND SANITATION CORPORATION LTD WASAC BRANCH

14/04/2021

ENGINE PUMPS & BULK METERS DISRIBUTIONS LIST IN KACYIRU BRANCH

N0	ENGINE PUMP DESCRIPTION	BULK METER DESCRIPTION	LOCATION	PUBLIC TAP MANAGER (NAME & SIGNATURE)
1	HONDA WD 30XT, GCBRT - 3155248	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 1915 9516	GASANZE 1	MUNYEMANA Déo
2	HONDA WD 30XT, GCBRT - 3151302	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6158	GASANZE 2	SENGABO Emmanuel C/o MUREKATETE
3	HONDA WD 30XT, GCBRT - 3155256	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 1915 9581	GASANZE 3	MUKANDAHIRO Anitha IRADUKUNDA Diane (C/o)
4	HONDA WD 30XT, GCBRT - 3155260	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6196	NDUBA 1	SIBOMANA Emmanuel C/o Attendant Eric
5	HONDA WD 30XT, GCBRT - 3155252	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6199	NDUBA 2	NDAGIRIYEMUNGU Thogene
6	HONDA WD 30XT, GCBRT - 3155253	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6197	NTORA	MUKASKYAKA Olive C/o SEBAHANI (Attendant)



WASAC TEAM

Kamana J.C Technician Of Kacyiru Branch

Musabyeyezu Jeanne

14/04/2021

ENGINE PUMPS & BULK METERS DISRIBUTIONS LIST IN NYARUGENGE BRANCH

N0	ENGINE PUMP DESCRIPTION	BULK METER DESCRIPTION	LOCATION	PUBLIC TAP MANAGER (NAME & SIGNATURE)
1	HONDA WD 30XT, GCBRT - 3155249	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6175	NATIONAL	NDUWIMANA Joseph.
2	HONDA WD 30XT, GCBRT - 3155246	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6155	NYAGASOZI	HAKIZIMANA Innocent
3	HONDA WD 30XT, GCBRT - 3155244	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6167	REBERO	AKAYEZU Celine
4	HONDA WD 30XT, GCBRT - 3155318	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6160	AMAKAWA	MUKANTAGHAZWA Florence

WASAC MEMBERS

Uwingeneye Donath
Plombier

Patrick Ndayisaba

14/04/24

Approved
Saranda Catherine
Head of Nyaruguge
Branch.

21/04/2024

WATER AND SANITATION CORPORATION Ltd
WASAC
NEW NYARUGENGE BRANCH

ENGINE PUMPS DISRIBUTIONS LIST IN NYARUGENGE BRANCH

N0	ENGINE PUMP DESCRIPTION	LOCATION	PUBLIC TAP MANAGER (NAME & SIGNATURE)
1	GCBRT-3155249	National	NDUWIMANA Joseph
2	GCBRT-3155246	Nyagasozi	HAKIZIMANA Innocent
3	GCBRT-3155244	Rebero	AKAYEZU Celine
4	GCBRT-3155318	Amakawa	MUKANTAGANZWA Florence

WASAC TEAM

Uwingeneye Donath
Plombier

Patrick NSENGIYUMVA
14/04/21

JICA TEAM

Vedaste ITANGISHAKA
Assistant NRW project
WASAC - JICA

Approved

21/04/2021
Saranda Catherine
Head of Nyarugenge

WATER AND SANITATION CORPORATION LTD
WASAC
NEW NYARUGENGE BRANCH

ENGINE PUMPS & BULK METERS DISRIBUTIONS LIST IN KANOMBEBRANCH

N0	ENGINE PUMP DESCRIPTION	BULK METER DESCRIPTION	LOCATION	PUBLIC TAP MANAGER (NAME & SIGNATURE)
1	HONDA WD 30XT, GCBRT - 3155298	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 0317	GITARAGA 1	TWAGIRIMANA Ferdinand
2	HONDA WD 30XT, GCBRT - 3155241	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 1915 9525	GITARAGA 2	UWAJEZU Pascaline
3	HONDA WD 30XT, GCBRT - 3155317	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 0314	MUYUMBU 1	NYIRAKAMANA Perpetue
4	HONDA WD 30XT, GCBRT - 3155328	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6200	MUYUMBU 2	NKESHIMANA Serge
5	HONDA WD 30XT, GCBRT - 3155245	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6193	GASARABA	NKAMANZA Anadelie 1196870008937204 1
6	HONDA WD 30XT, GCBRT - 3155297	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6168	BUSANZA - MASARO	ZIGIRIMANA Bonifa 1197280010772 50 42
7	HONDA WD 30XT, GCBRT - 3155315	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6152	BUSANZA - GIKUNDIRO 1197280	HAKORIMANA Théoneste 22
8	HONDA WD 30XT, GCBRT - 3155330	ZENNER, DN 50. SERIES NUMBER: 8ZRI 84 2000 6191	BUSANZA - GASHYUSHYA 1198380019831	KERETIMANA Xavier 4186

WASAC TEAM

Kigali le 19/02/2021
Bicamumpaka Jean

Anadelie MUKIZA
Head of Kanombe Branch

ENGINE PUMPS DISRIBUTIONS LIST IN KANOMBE BRANCH

N0	ENGINE PUMP DESCRIPTION	LOCATION	PUBLIC TAP MANAGER (NAME & SIGNATURE)
1	GCBRT-3155298	GITARAGA1	TWAGIRIMANA Ferdinand
2	GCBRT-3155241	GITARAGA 2	UWAJEZU Pascaline
3	GCBRT-3155317	MUYUMBU1	NYIRAKAMANA Perpetue
4	GCBRT-3155328	MUYUMBU 2	NKESHIMANA Serge
5	GCBRT-3155245	GASARABA	MUKAMANA Anatalie
6	GCBRT-3155297	~~BUSANZA~~ MASARO	ZIGIRIMANA Bonface
7	GCBRT-3155315	BUSANZA GIKUNDIRO	~~HAKORIMANA~~ Théoneste
8	GCBRT-3155330	BUSANZA GASHYUSHYA	KERETIMANA Xavier

WASAC TEAM

19/02/2021
Bicamumpaka Jean

JICA TEAM

Vedaste ITANGISHAKA
Assistant NRW Project
WASAC – JICA

Anaclet MUKIZA
Head of Kanombe
Branch

2 . EQUIPMENT AND MATERIALS OF PIPE AND FITTINGS FOR NETWORK LEAKAGE REPAIR AND PIPING WORK TOOLS

DELIVERY NOTES OF MATERIALS FROM JICA TO WASAC LTD

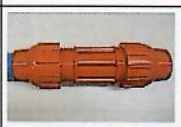
Procurement of the Materials and Equipment of Pipe and Fittings for Network Leakage Repair and Piping Work Tools for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

Date: 28/6/2021

No	Items	Photo	DN	Specification	Qty	Unit Price (RWF)	Price (RWF)
A. Pipe and Fittings for Network Leakage Repair							
1	PVC socket for repair joined with gasket		DN63	Rubber Ring Coupling, Coupling F/F Material: PVC or UPVC Connection: Rubber Type EPDM Standard: ISO4422, ISO1452, GBT10002 Size: 63mm Pressure: PN16 Flexible or Rigid: Flexible Color: Black,Grey,Blue	75	32,000	2,400,000
2	Ductile Iron clamp saddles		DN 110x3/4"	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN110/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	175	40,000	7,000,000
3	Ductile Iron clamp saddles		DN 90x3/4'	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN90/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	300	35,000	10,500,000
4	Ductile Iron clamp saddles		DN 63x3/4"	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN63/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	500	35,000	17,500,000
5	PPR Ganga Pipes		DN3/4"	Material: POLYPROPYLENE/PPR Length: 6 meters Thickness: 2.0-23.3mm Size: DN3/4" Pressure : PN16 Colors: green, white or gray Application: Hot and cold water Supply System STANDARD DIN8077/8078, ISO9001,ISO14001	500	11,000	5,500,000
6	PPR Ganga Pipes		DN1"	Material: POLYPROPYLENE/PPR Length: 6 meters Thickness: 2.0-23.3mm Size: DN1" Pressure : PN16 Colors: green, white or gray Application: Hot and cold water Supply System STANDARD DIN8077/8078, ISO9001,ISO14001	300	15,000	4,500,000

DELIVERY NOTES OF MATERIALS FROM JICA TO WASAC LTD

Procurement of the Materials and Equipment of Pipe and Fittings for Network Leakage Repair and Piping Work Tools for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

7	GS Nipple		1"	Size : 1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	30	2,200	66,000
8	GS bend		1"	Material: Galvanized Steel Type Elbow Degree of Angle 90 Size: 1" Pressure: PN 16 Inlet Thread Type Female Outlet Thread Type Female	150	2,200	330,000
9	PPR socket (for PPR Pipe)		1"	Material : POLYPROPYLENE/PPR Usage : Pipe Fittings Size : 1" Pressure: PN 16 ISO1452	75	5,500	412,500
10	Ball Valve		3/4"	Inlet and Outlet thread: Female Size: (DN) 3/4" Work pressure (PN) 16 bar Material : brass	200	9,000	1,800,000
11	Ball Valve		1"	Inlet and Outlet thread: Female Size: (DN) 1" Work pressure (PN) 16 bar Material : brass	100	11,000	1,100,000
				Sub Total all taxes inclusive (RWF)			**51,108,500**
B. Piping Work Tools							
1	Drilling machine for water pipes		-	Type: Manual under pressure drilling machine appropriate for PVC pipe, polyethylene pipe, Ductile iron and Steel galvanized pipe. Cutter Size:3/4", 1" Accessories: Tool box which contains necessary parts To be supplied one set of spare parts of cutters of each diameter. Recommended product : Hy-Ram(Junior J1)	6	3,100,000	18,600,000
2	Manual Pressure Testing Pump		-	Testing and pressure range: 0-30 bar Tank capacity: not less than 10L	6	400,000	2,400,000
				Sub Total all taxes inclusive (RWF)			**21,000,000**
				TOTAL all taxes inclusive (RWF)			**72,108,500**
				TOTAL all taxes inclusive (US Dollar)			**72,837**

Prepared by:

MR. ITANGISHAKA VEDASTE
ASSISTANT NRW PROJECT
WASAC / JICA

MR. SHIGEO OTANI
CHIEF ADVISOR
JICA EXPERT TEAM
JAPAN

Approved by:

MR. METHODE RUTAGUNGIRA
PROJECT DIRECTOR & DIRECTOR OF URBAN WATER AND SEWARAGE SERVICES
WASAC LTD

INSPECTION RECORD

Procurement of the Materials and Equipment of Pipe and Fittings for Network Leakage Repair and Piping Work Tools for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

No	Items	Photo	DN	Specification	Quantity	Observations
				A. Pipe and Fittings for Network Leakage Repair		
1	PVC socket for repair joined with gasket		DN63	Rubber Ring Coupling, Coupling F/F Material: PVC or UPVC Connection: Rubber Type EPDM Standard: ISO4422, ISO1452, GBT10002 Size: 63mm Pressure: PN16 Flexible or Rigid: Flexible Color: Black,Grey,Blue	75	Received
5	PPR Ganga Pipes		DN3/4"	Material: POLYPROPYLENE/PPR Length: 6 meters Thickness: 2.0-23.3mm Size: DN3/4" Pressure : PN16 Colors: green, white or gray Application: Hot and cold water Supply System STANDARD DIN8077/8078, ISO9001,ISO14001	500	Received
6	PPR Ganga Pipes		DN1"	Material: POLYPROPYLENE/PPR Length: 6 meters Thickness: 2.0-23.3mm Size: DN1" Pressure : PN16 Colors: green, white or gray Application: Hot and cold water Supply System STANDARD DIN8077/8078, ISO9001,ISO14001	300	Received
7	GS Nipple		1"	Size : 1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	30	Received
8	GS bend		1"	Material: Galvanized Steel Type Elbow Degree of Angle 90 Size: 1" Pressure: PN 16 Inlet Thread Type Female	150	Received
9	PPR socket (for PPR Pipe)		1"	Material : POLYPROPYLENE/PPR Usage : Pipe Fittings Size : 1" Pressure: PN 16 ISO1452	75	Received
10	Ball Valve		3/4"	Inlet and Outlet thread: Female Size: (DN) 3/4" Work pressure (PN) 16 bar Material : brass	200	Received
11	Ball Valve		1"	Inlet and Outlet thread: Female Size: (DN) 1" Work pressure (PN) 16 bar Material : brass	100	Received

DATE: 12/3/2021

MEMBERS

WASAC

NAMES	FUNCTION	SIGNATURE
UWUMUREMYI Felicien	standard & quality Control Officer	

JICA

NAMES	FUNCTION	SIGNATURE
Vedaste ITANGISHAKA	Assistant NRW project IWASAC-JICA	

CONTRACTOR

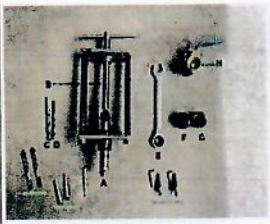
NAMES	FUNCTION	SIGNATURE
MUKAKARISA Vestine	Managing Director	

VESCO WATER MATERIAL SUPPLY
TIN: 112334050
TEL:0788504778
KIGALI-RWANDA

INSPECTION RECORD

Procurement of the Materials and Equipment of Pipe and Fittings for Network Leakage Repair and Piping Work Tools for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

Date: 17-Jun-21

No	Items	Photo	Specification	Quantity	Observations
B. Piping Work Tools					
1	Drilling machine for water pipes		Type: Manual under pressure drilling machine appropriate for PVC pipe, polyethylene pipe, Ductile iron and Steel galvanized pipe. Cutter Size:3/4", 1" Accessories: Tool box which contains necessary parts To be supplied one set of spare parts of cutters of each diameter.	6	Well Received.
2	Manual Pressure Testing Pump		Testing and pressure range: 0-30 bar Tank capacity: not less than 10L	6	Well Received.

MEMBERS

WASAC TEAM

NAMES	FUNCTION	SIGNATURE
UWUMUREMYI Felicien	standard & Quality Control officer	
MUGABO J.M.V	leak detection & pressure management operator	

JICA TEAM

NAMES	FUNCTION	SIGNATURE
Vedaste ITANGISAKA	Assistant NRW project WASAC - JICA.	
Shigeo OTANI	JICA Expert	

CONTRACTOR TEAM

NAMES	FUNCTION	SIGNATURE
Vedaste UWITENE	General Manager	

VEDCO WATER MATERIAL SUPPLY
TIN: 112334050
TEL: 0788504778
KIGALI-RWANDA

INSPECTION RECORD

Procurement of the Materials and Equipment of Pipe and Fittings for Network Leakage Repair and Piping Work Tools for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

Date: 17-Jun-21

No	Items	Photo	Specification	Quatity	Observations
1	Ductile Iron clamp saddles		Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN110/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	175	Well Received
2	Ductile Iron clamp saddles		Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN90/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	300	Well Received
3	Ductile Iron clamp saddles		Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN63/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	500	Well Received.

MEMBERS

WASAC TEAM

NAMES	FUNCTION	SIGNATURE
UWUNUREMYI Félicien	Standard & Quality Control officer	
MUGABO J.MV	Leak detection and pressure mgt operator	

JICA TEAM

NAMES	FUNCTION	SIGNATURE
Vedaste ITANGISHAKA	Assistant NRW Project WASAC - JICA	
Shigao OTANI	JICA Expert	

CONTRACTOR TEAM

NAMES	FUNCTION	SIGNATURE
Vedaste KAPTIENE	General Manager	

WATER MATERIAL SUPPLY
TIN: 112334050
TEL: 0788504778
KIGALI-RWANDA


SANVA

3 . EQUIPMENT AND MATERIALS OF DISTRIBUTION AND SERVICE PIPE FOR REPLACEMENT

DELIVERY NOTES OF MATERIALS FROM JICA TO WASAC LTD

Procurement of the Materials and Equipment of Distribution and Service Pipe for Replacement for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

Date: 28/6/2021

No	Items	Photo	UNIT	Specification	Qty	Unit Price (RWF)	Price (RWF)
A. Pipe and Fittings for Service Pipe Replacement							
1	HDPE pipes DN50 PN 16		lm	Size: DN50mm Pressure : PN16 STANDARD : PE100 in accordance with ISO 4427-2 requirements. Supplied in rolls of 200m Quantity: 200m roll x 13 rolls	2,600	3,800	9,880,000
2	PPR (Ganga type) pipes 3/4" PN 16		Pcs	Material: POLYPROPYLENE/PPR Length: 6 meters Thickness: 2.0-23.3mm Size: DN3/4" Pressure : PN16 Colors: green, white or gray Application: Hot and cold water Supply System STANDARD DIN8077/8078, ISO9001,ISO14001	250	11,500	2,875,000
3	PPR (Ganga type) pipes 1" PN 16		Pcs	Material: POLYPROPYLENE/PPR Length: 6 meters Thickness: 2.0-23.3mm Size: DN3/4" Pressure : PN16 Colors: green, white or gray Application: Hot and cold water Supply System STANDARD DIN8077/8078, ISO9001,ISO14001	200	14,500	2,900,000
4	Screwed clamp for pvc 200* 3/4" PN 16 (type DI)			Body Ductile Iron		180,000	720,000
5	Screwed clamp for pvc 200*1 1/2" PN 16 (type DI)					185,000	555,000
6	Screwed clamp for pvc 110* 1" PN 16 (type DI)					110,000	440,000
7	Screwed clamp for pvc 75*1" PN 16 (type DI)					75,000	150,000
8	Screwed clamp for pvc 63*1 1/2" PN 16 (type DI)		Pcs	Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN63/ 1' 1/2' Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	5	70,000	350,000

Delivery Note Item 2.

9	Screwed clamp for pvc 63*1" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN63/ 1" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	2	65,000	130,000
10	Screwed clamp for pvc 50*1" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN50/ 1" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	3	55,000	165,000
11	Screwed clamp for pvc 50*3/4" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN50/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	84	50,000	4,200,000
12	Nipple 1 1/2" galvanized PN 16		Pcs	Size : 1 1/2' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	9	5,500	49,500
13	Nipple 1 1/4" galvanized PN 16		Pcs	Size : 1 1/2' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	10	5,500	55,000
14	Nipple 1" galvanized PN 16		Pcs	Size : 1' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	137	4,500	616,500
15	Nipple 3/4" galvanized PN 16		Pcs	Size : 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	332	3,500	1,162,000
16	Compression adaptor for HDPE DN50x1"1/2 PN16		Pcs	Material : POLYPROPYLENE/PPR Usage : Pipe fittings Male threaded on one side and IPS compression on other side Size : DN 50X 1"1/2 Pressure: PN 16	16	8,500	136,000
17	Union 1" galvanized PN 16		Pcs	Size : 1' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	103	4,500	463,500
18	Union 1 1/4" galvanized PN 16		Pcs	Size : 1 1/2' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	6	5,500	33,000
19	Union 3/4" galvanized PN 16		Pcs	Size : 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	180	3,500	630,000
20	Ball valve 1 1/2" PN 16		Pcs	Inlet and Outlet thread: Female Size: (DN) 1 1/2' Work pressure (PN) 16 bar Material : brass	7	16,000	112,000
21	Ball valve 1" PN 16		Pcs	Inlet and Outlet thread: Female Size: (DN) 1" Work pressure (PN) 16 bar Material : brass	15	15,000	225,000
22	Ball valve 3/4" PN 16		Pcs	Inlet and Outlet thread: Female Size: (DN) 3/4" Work pressure (PN) 16 bar Material : brass	147	11,000	1,617,000
23	Galvanized Tee 1 1/2"		Pcs	Inlet and Outlet thread: Female Size : 1 1/2" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	3	6,500	19,500
24	Galvanized Tee 1" PN 16		Pcs	Inlet and Outlet thread: Female Size : 1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	38	4,500	171,000

25	Galvanized Tee 3/4" PN 16		Pcs	Inlet and Outlet thread: Female Size : 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	11	3,500	38,500
26	Galvanized elbow (90°) 1" PN 16		Pcs	Material: Galvanized Steel Type Elbow Degree of Angle 90 Size: 1" Pressure: PN 16 Inlet Thread Type Female Outlet Thread Type Female	6	4,000	24,000
27	Galvanized elbow (90°) 3/4" PN 16		Pcs	Material: Galvanized Steel Type Elbow Degree of Angle 90 Size: 3/4" Pressure: PN 16 Inlet Thread Type Female Outlet Thread Type Female	159	3,500	556,500
28	Galvanized end cup female 1"		Pcs	thread: Female Size : 1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	6	7,000	42,000
29	Galvanized Reduces 1*3/4"		Pcs	Inlet and Outlet thread: Female Size : 1*3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	37	9,000	333,000
30	Galvanized Reduces 40mm*1"		Pcs	Inlet and Outlet thread: Female Size : 40mm*1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	2	9,000	18,000
31	Galvanized Reduced 1 1/2" * 3/4"		Pcs	Inlet and Outlet thread: Female Size : 1 1/2" * 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	3	6,000	18,000
32	Compression End cup for HDPE DN 50 mm PN16		Pcs	Material : POLYPROPYLENE/PPR Usage : IPS ompression connected to outside diameter of pipes Size : DN 50 Pressure: PN 16	8	7,500	60,000
33	Galvanized Socket 1" PN 16		Pcs	Inlet and Outlet thread: Female Size : 1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	214	5,000	1,070,000
34	Galvanized Socket 3/4" PN 16		Pcs	Inlet and Outlet thread: Female Size : 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	275	4,000	1,100,000
35	Teflon		Pcs		595	500	297,500
Sub Total all taxes inclusive (RWF)							**31,212,500**

B. Material and Equipment for Meter Replacement							
36	Bulk Meter DN150 PN16		Pcs	Type: Woltman turbine meter (Horizontal turbine shaft: WPH) Diameter Nominal: DN150mm Nominal Pressure: PN16 EEC Metrological class : B Hermetically sealed register:IP68	1	1,650,000	1,650,000
37	Strainer DN150		Pcs	Diameter Nominal: DN150mm Nominal Pressure: PN16 Structure: Ductile Iron body, epoxy coating, Flanged two sides,	1	500,000	500,000
38	Flange Adaptor DN 150		Pcs	Diameter Nominal: DN150mm Type: Big tolerance flange adapter (That can feet to GP, PVC, DI, HDPE… of same diameter), Nominal Pressure: PN16 Ductile Iron Body	2	200,000	400,000
39	Gasket DN 150		Pcs	Plastic or caoutchouc, EPDM gasket	6	4,500	27,000
40	Bolt,Nut (M20, L=100)		Pcs	Galvanized steel body, hexagonal head, entirely threaded (full thread), with washer	42	2,500	105,000
Sub Total all taxes inclusive (RWF)							**2,682,000**
TOTAL all taxes inclusive (RWF)							**33,894,500**
TOTAL all taxes inclusive (US Dollar)							**34,000**

PREPARED BY:

MR. ITANGISHAKA VEDASTE

ASSISTANT NRW PROJECT

WASAC / JICA

APPROUVED BY:

MR. SHIGEO OTANI

CHIEF ADVISOR

JICA EXPERT TEAM

JAPAN

MR. METHODE RUTAGUNGIRA

PROJECT DIRECTOR & DIRECTOR OF URBAN WATER AND SEWARAGE SERVICES

WASAC LTD

INSPECTION RECORD

Procurement of the Materials and Equipment of Distribution and Service Pipe for Replacement for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

Date: 10-Jun-21

No	Items	Photo	UNIT	Specification	Quantity	Quantity Receiveid	Comments
A. Pipe and Fittings for Service Pipe Replacement							
1	HDPE pipes DN50 PN 16		lm	Size: DN50mm Pressure : PN16 STANDARD : PE100 in accordance with ISO 4427-2 requirements. Supplied in rolls of 200m Quantity: 200m roll x 13 rolls	2,600	2,600	RECEIVED
2	PPR (Ganga type) pipes 3/4" PN 16		Pcs	Material: POLYPROPYLENE/PPR Length: 6 meters Size: DN3/4" Pressure : PN16 Colors: green, white or gray Application: Hot and cold water Supply System STANDARD DIN8077/8078, ISO9001,ISO14001	250	250	RECEIVED
3	PPR (Ganga type) pipes 1" PN 16		Pcs	Material: POLYPROPYLENE/PPR Length: 6 meters Size: DN1" Pressure : PN16 Colors: green, white or gray Application: Hot and cold water Supply System STANDARD DIN8077/8078, ISO9001,ISO14001	200	200	RECEIVED
4	Screwed clamp for pvc 200* 3/4" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN200/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	4	4	RECEIVED
5	Screwed clamp for pvc 200*1 1/2" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN200/ 1' 1/2' Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	3	3	RECEIVED
6	Screwed clamp for pvc 110* 1" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN110/ 1" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	4	4	RECEIVED
7	Screwed clamp for pvc 75*1" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN75/ 1" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	2	2	RECEIVED
8	Screwed clamp for pvc 63*1 1/2" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN63/ 1' 1/2' Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	5	5	RECEIVED

9	Screwed clamp for pvc 63*1" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN63/ 1" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	2	2	RECEIVED
10	Screwed clamp for pvc 50*1" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN50/ 1" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	3	3	RECEIVED
11	Screwed clamp for pvc 50*3/4" PN 16 (type DI)		Pcs	Body Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Size: DN50/ 3/4" Pressure: PN16 Connection pipe: PVC, steel, HDPE, DI	84	84	RECEIVED
12	Nipple 1 1/2" galvanized PN 16		Pcs	Size : 1 1/2' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	9	9	RECEIVED
13	Nipple 1 1/4" galvanized PN 16		Pcs	Size : 1 1/2' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	10	10	RECEIVED
14	Nipple 1" galvanized PN 16		Pcs	Size : 1' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	137	137	RECEIVED
15	Nipple 3/4" galvanized PN 16		Pcs	Size : 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	332	332	RECEIVED
16	Compression adaptor for HDPE DN50x1"1/2 PN16		Pcs	Material : POLYPROPYLENE/PPR Usage : Pipe fittings Male threaded on one side and IPS compression on other side Size : DN 50X 1"1/2 Pressure: PN 16	16	16	RECEIVED
17	Union 1" galvanized PN 16		Pcs	Size : 1' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	103	103	RECEIVED
18	Union 1 1/4" galvanized PN 16		Pcs	Size : 1 1/2' Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	6	6	RECEIVED
19	Union 3/4" galvanized PN 16		Pcs	Size : 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	180	180	RECEIVED
20	Ball valve 1 1/2" PN 16		Pcs	Inlet and Outlet thread: Female Size: (DN) 1 1/2' Work pressure (PN) 16 bar Material : brass	7	7	RECEIVED
21	Ball valve 1" PN 16		Pcs	Inlet and Outlet thread: Female Size: (DN) 1" Work pressure (PN) 16 bar Material : brass	15	15	RECEIVED
22	Ball valve 3/4" PN 16		Pcs	Inlet and Outlet thread: Female Size: (DN) 3/4" Work pressure (PN) 16 bar Material : brass	147	147	RECEIVED
23	Galvanized Tee 1 1/2"		Pcs	Inlet and Outlet thread: Female Size : 1 1/2" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	3	3	RECEIVED
24	Galvanized Tee 1" PN 16		Pcs	Inlet and Outlet thread: Female Size : 1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	38	38	RECEIVED

25	Galvanized Tee 3/4" PN 16		Pcs	Inlet and Outlet thread: Female Size : 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	11	11	RECEIVED
26	Galvanized elbow (90°) 1" PN 16		Pcs	Material: Galvanized Steel Type Elbow Degree of Angle 90 Size: 1" Pressure: PN 16 Inlet Thread Type Female Outlet Thread Type Female	6	6	RECEIVED
27	Galvanized elbow (90°) 3/4" PN 16		Pcs	Material: Galvanized Steel Type Elbow Degree of Angle 90 Size: 3/4" Pressure: PN 16 Inlet Thread Type Female Outlet Thread Type Female	159	159	RECEIVED
28	Galvanized end cup female 1"		Pcs	thread: Female Size : 1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	6	6	RECEIVED
29	Galvanized Reduces 1*3/4"		Pcs	Inlet and Outlet thread: Female Size : 1*3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	37	37	RECEIVED
30	Galvanized Reduces 40mm*1"		Pcs	Inlet and Outlet thread: Female Size : 40mm*1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	2	2	RECEIVED
31	Galvanized Reduced 1 1/2" * 3/4"		Pcs	Inlet and Outlet thread: Female Size : 1 1/2" * 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	3	3	RECEIVED
32	Compression End cup for HDPE DN 50 mm PN16		Pcs	Material : POLYPROPYLENE/PPR Usage : IPS ompression connected to outside diameter of pipes Size : DN 50 Pressure: PN 16	8	8	RECEIVED
33	Galvanized Socket 1" PN 16		Pcs	Inlet and Outlet thread: Female Size : 1" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	214	214	RECEIVED
34	Galvanized Socket 3/4" PN 16		Pcs	Inlet and Outlet thread: Female Size : 3/4" Pressure: PN 16 Material: Galvanized Steel Usage Pipe Fitting	275	275	RECEIVED
35	Teflon		Pcs		595	595	RECEIVED

B. Material and Equipment for Meter Replacement							
36	Bulk Meter DN150 PN16		Pcs	Type: Woltman turbine meter (Horizontal turbine shaft: WPH) Diameter Nominal: DN150mm Nominal Pressure: PN16 EEC Metrological class : B Hermetically sealed register:IP68	1	0	Not Received, Item will be procured from out country. The contractor still waiting the package
37	Strainer DN150		Pcs	Diameter Nominal: DN150mm Nominal Pressure: PN16 Structure: Ductile Iron body, epoxy coating, Flanged two sides,	1	1	RECEIVED
38	Flange Adaptor DN 150		Pcs	Diameter Nominal: DN150mm Type: Big tolerance flange adapter (That can feet to GP, PVC, DI, HDPE... of same diameter), Nominal Pressure: PN16 Ductile Iron Body	2	2	RECEIVED
39	Gasket DN 150		Pcs	Plastic or caoutchouc, EPDM gasket	6	6	RECEIVED
40	Bolt,Nut (M20, L=100)		Pcs	Galvanized steel body, hexagonal head, entirely threaded (full thread), with washer	42	42	RECEIVED

MEMBERS OF INSPECTION RECORD

Date: 10 June 2021

WASAC Ltd

NAMES	FUNCTION	SIGNATURE
NTAMUTURANO Désiré	Head of LD of PM	
UWUTWEMI Félicien	Standard & Quality Control officer	

JICA

NAMES	FUNCTION	SIGNATURE
Vedaste ITANGISHAKA	Assistant NRW project WASAC-JICA	
Shigeo OTANI	JICA Expert	

CONTRACTOR

NAMES	FUNCTION	SIGNATURE
New earth construction Company Ltd	managing director	NEW EARTH CONSTRUCTION COMPANY Ltd

SECOND INSPECTION RECORD

Procurement of the Materials and Equipment of Distribution and Service Pipe for Replacement for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

Date: 18-Jun-21

No	Items	Photo	UNIT	Specification	Quantity	Quantity Receiveid	Comments
B. Material and Equipment for Meter Replacement							
1	Bulk Meter DN150 PN16		Pcs	Type: Woltman turbine meter (Horizontal turbine shaft: WPH) Diameter Nominal: DN150mm Nominal Pressure: PN16 EEC Metrological class : B Hermetically sealed register:IP68	1	1	RECEIVED

MEMBERS OF INSPECTION RECORD **Date: 18 June 2021**

WASAC Ltd

NAMES	FUNCTION	SIGNATURE
NTAMUTURANO Désiré	Head of Leak detection & P.M	
UWURWRENZI Félicien	standard & quality Control officer	

JICA

NAMES	FUNCTION	SIGNATURE
Vedaste ITANGISHAKA	Assistant NRW Project WASAC – JICA	
Shigeo OTAKI	JICA Expert	

CONTRACTOR

NAMES	FUNCTION	SIGNATURE
New earth Construction Company Ltd	managing Director	

PHOTOS OF MATERIALS

4 . EQUIPMENT AND MATERIALS OF FLOATS VALVES

DELIVERY NOTES OF MATERIALS FORM JICA TO WASAC LTD

Procurement of the Materials and Equipment of Float Valve for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

Date: 20/10/2021

No	Items	Photo	Unit	Specification	Qty	Unit Price (RWF)	Price (RWF)
1	Flanged float valve DN50 including all accessories.(Bolts& Nuts, Gaskets)		Pcs	Function: Automatically controls the rate of filling, and will shut off when a predetermined water level is reached. Type: an equilibrium, single seat upstream pressure balanced float valve Installation body pattern: angle pattern. Pressure: PN16 bars Max. allowable pressure drop (Dp) across the valve: more than 8 bar Structure: Ductile Iron body, epoxy coating, stainless steel float	1	1,400,000	1,400,000
2	Flanged float valve DN80 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	2,300,000	4,600,000
3	Flanged float valve DN100 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	3,200,000	6,400,000
4	Flanged float valve DN150 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		1	5,200,000	5,200,000
5	Flanged float valve DN200 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		7	6,500,000	45,500,000
6	Flanged float valve DN250 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	8,200,000	16,400,000
8	Flanged gate valve DN50 including all accessories.(Bolts& Nuts, Gaskets)		Pcs	Body :Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Pressure: PN16 size: F4, stainless steel valve stem, Blue Epoxy paint of 250µ, clamp ring and rotating Whell	3	80,000	240,000
9	Flanged gate valve DN80 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	225,000	450,000
10	Flanged gate valve DN100 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		1	213,500	213,500
11	Flanged gate valve DN200 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		5	500,000	2,500,000
12	Flanged gate valve DN300 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		1	750,000	750,000
13	Weld flange DN 200, PN 16 including all accessories.(Bolts& Nuts, Gaskets)		Pcs	Body Ductile Iron Bolt & Nut Zinc Plated Steel ISO898-1:1999 Pressure: PN16	4	150,500	602,000
14	Dismentling joint DN80 PN16		Pcs	Size : 80mm Pressure: PN 16 Body Ductile Iron Studs & Nut Zinc Plated Steel ISO898-1:1999 Rubber Seal Rubber EPDM	1	150,500	150,500

15	Large tolerance flange adaptor/ Coupling for Steel Pipe DN100 (Odrange 108-128)including all accessories.(Bolts& Nuts, Gaskets)		Pcs	Big tolerance flange adapter with EPDM gasket and brass grip ring inside (That can fit to GS, PVC, DI, HDPE... of same diameter), Pressure:PN16 Ductile Iron Body Bolt & Nut Zinc Plated Steel ISO898-1:1999 Rubber Seal Rubber EPDM	1	150,000	150,000
16	Large tolerance flange adaptor/ Coupling for Steel Pipe DN200(OD range 198-225) including all accessories.(Bolts& Nuts, Gaskets)		Pcs		3	203,000	609,000
17	Large tolerance flange adaptor/ Coupling for Steel Pipe DN250(OD range 250-280) including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	280,000	560,000
TOTAL all taxes inclusive (RWF)							**85,725,000**

TOTAL all taxes inclusive (US Dollar)	**85,725**

PREPARED BY:

MR. VEDASTE ITANGISHAKA

Assistant NRW Project

WASAC / JICA

APPROUVED BY

MR. TSUTSUI NOBUYUKI

JICA EXPERT TEAM

JAPAN

MR. METHODE RUTAGUNGIRA

PROJECT DIRECTOR & DIRECTOR OF URBAN WATER AND SEWARAGE SERVICE

VESCO WATER MATERIALS SUPPLY

Tin:112334050
Tel: 0788504778
Email:vescowater@gmail.com

Delivery Note

Customer Names: **Kyowa ENGINEERING CONSULTANTS CO., LTD**

Date of Delivery: **Friday, 15/10/2021**

No	Items	Quantity Delivered in Pcs
1	Flanged float valve DN50 including all accessories.(Bolts& Nuts, Gaskets)	1
2	Flanged float valve DN80 including all accessories.(Bolts& Nuts, Gaskets)	2
3	Flanged float valve DN100 including all accessories.(Bolts& Nuts, Gaskets)	2
4	Flanged float valve DN150 including all accessories.(Bolts& Nuts, Gaskets)	1
5	Flanged float valve DN200 including all accessories.(Bolts& Nuts, Gaskets)	7
6	Flanged float valve DN250 including all accessories.(Bolts& Nuts, Gaskets)	2
8	Flanged gate valve DN50 including all accessories.(Bolts& Nuts, Gaskets)	3
9	Flanged gate valve DN80 including all accessories.(Bolts& Nuts, Gaskets)	2
10	Flanged gate valve DN100 including all accessories.(Bolts& Nuts, Gaskets)	1
11	Flanged gate valve DN200 including all accessories.(Bolts& Nuts, Gaskets)	5

VESCO WATER MATERIALS SUPPLY

Tin:112334050
Tel: 0788504778
Email:vescowater@gmail.com

12	Flanged gate valve DN300 including all accessories.(Bolts& Nuts, Gaskets)	1
13	Weld flange DN 200, PN 16 including all accessories.(Bolts& Nuts, Gaskets)	4
14	Dismentling joint DN80 PN16	1
15	Large tolerance flange adaptor/ Coupling for Steel Pipe DN100 (Odrange 108-128)including all accessories.(Bolts& Nuts, Gaskets)	1
16	Large tolerance flange adaptor/ Coupling for Steel Pipe DN200(OD range 198-225) including all accessories.(Bolts& Nuts, Gaskets)	3
17	Large tolerance flange adaptor/ Coupling for Steel Pipe DN250(OD range 250-280) including all accessories.(Bolts& Nuts, Gaskets)	2

VESCO WATER MATERIAL SUPPLY TIN: 112334050 TEL:0788504778 KIGALI-RWANDA

VESCO WATER MATERIAL SUPPLY LTD

Prepared By: VESCO

Received by : Vedaste ITANGISHAKA
Assistant NLTG project
UWIMANENYI Felicien
Standard & Quality control officer
MUGABO JMV
Leak detection and pressure mgt operator

INSPECTION RECORD

Procurement of the Materials and Equipment of Float Valve for Reduction of Intermittent Water Supply to Support in Covid-19 Response within the Framework of the Project for Strengthening Non-Revenue Water Control in Kigali City Network

Date: 15/10/2021

No	Items	Photo	Unit	Specification	Qty	Qty Received	Comments
1	Flanged float valve DN50 including all accessories.(Bolts& Nuts, Gaskets)		Pcs	Function: Automatically controls the rate of filling, and will shut off when a predetermined water level is reached. Type: an equilibrium, single seat upstream pressure balanced float valve Installation body pattern: angle pattern. Pressure: PN16 bars Max. allowable pressure drop (Dp) across the valve: more than 8 bar Structure: Ductile Iron body, epoxy coating, stainless steel float	1	1	Received
2	Flanged float valve DN80 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	2	Received
3	Flanged float valve DN100 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	2	Received
4	Flanged float valve DN150 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		1	1	Received
5	Flanged float valve DN200 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		7	7	Received
6	Flanged float valve DN250 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	2	Received
7	Flanged float valve DN300 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		0	0	X—X
8	Flanged gate valve DN50 including all accessories.(Bolts& Nuts, Gaskets)		Pcs	Body :Ductile Iron Rubber Seal Rubber EPDM Bolt & Nut Zinc Plated Steel ISO898-1:1999 Pressure: PN16 size: F4, stainless steel valve stem, Blue Epoxy paint of 250µ, clamp ring and rotating Whell	3	3	Received
9	Flanged gate valve DN80 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	2	Received
10	Flanged gate valve DN100 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		1	1	Received
11	Flanged gate valve DN200 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		5	5	Received
12	Flanged gate valve DN300 including all accessories.(Bolts& Nuts, Gaskets)		Pcs		1	1	Received
13	Weld flange DN 200, PN 16 including all accessories.(Bolts& Nuts, Gaskets)		Pcs	Body Ductile Iron Bolt & Nut Zinc Plated Steel ISO898-1:1999 Pressure: PN16	4	4	Received
14	Dismentling joint DN80 PN16		Pcs	Size : 80mm Pressure: PN 16 Body Ductile Iron Studs & Nut Zinc Plated Steel ISO898-1:1999 Rubber Seal Rubber EPDM	1	1	Received

15	Large tolerance flange adaptor/ Coupling for Steel Pipe DN100 (Odrange 108-128)including all accessories.(Bolts& Nuts, Gaskets)		Pcs	Big tolerance flange adapter with EPDM gasket and brass grip ring inside (That can fit to GS, PVC, DI, HDPE... of same diameter), Pressure:PN16 Ductile Iron Body Bolt & Nut Zinc Plated Steel ISO898-1:1999 Rubber Seal Rubber EPDM	1	1	Received
16	Large tolerance flange adaptor/ Coupling for Steel Pipe DN200(OD range 198-225) including all accessories.(Bolts& Nuts, Gaskets)		Pcs		3	3	Received
17	Large tolerance flange adaptor/ Coupling for Steel Pipe DN250(OD range 250-280) including all accessories.(Bolts& Nuts, Gaskets)		Pcs		2	2	Received
18	Large tolerance flange adaptor/ Coupling for Steel Pipe DN300 (OD range 315-326)including all accessories.(Bolts& Nuts, Gaskets)		Pcs		0	0	X—X

MEMBERS OF INSPECTION

WASAC LTD

NAMES	FUNCTION	SIGNATURE
UWONUREGYE Félicien	Standard & Quality Control officer	
MUGABO J.M.V	Leak detection and pressure mgt operator.	

JICA

NAMES	FUNCTION	SIGNATURE
Vedaste ITANGISHAKA	Assistant NRW project	
Tsutsui Nobuyuki	JICA Expert	

CONTRACTOR

NAMES	FUNCTION	SIGNATURE
KAMITENE Vedaste	Managing Director	

VESCO WATER MATERIAL SUPPLY
TIN: 112334050
TEL:0788804778
KIGALI-RWANDA

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

118568.0002

Purchase order no. MAIL

Manufacturer's order confirmation no. 1.368 Dated 15/06/2021

Manufacturer's trade mark

Product VALV. GALL. MOD. ATHENA DN50 PN16

Quantity N. 1,0000

Serial no.

Tests

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

Shell strength (test fluid: water)	1,5 PN	Test reference EN 1074-1
Seat tightness (test fluid: water)	1,1 PN	Test reference EN 1074-1

Final examination; Visual and dimensional check

Tests result without objection

118568.0003

Purchase order no. MAIL

Manufacturer's order confirmation no. 1.368 Dated 15/06/2021

Manufacturer's trade mark

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

Product VALV. GALL. MOD. ATHENA DN80 PN16

Quantity N. 2,0000

Serial no.

Tests

Shell strength (test fluid: water)	1,5 PN	Test reference EN 1074-1
Seat tightness (test fluid: water)	1,1 PN	Test reference EN 1074-1

Final examination; Visual and dimensional check

Tests result without objection

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

118568.0004

Purchase order no. MAIL

Manufacturer's order confirmation no. 1.368 Dated 15/06/2021

Manufacturer's trade mark

Product VALV. GALL. MOD. ATHENA DN100 PN16

Quantity N. 2,0000

Serial no.

Tests

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

Shell strength (test fluid: water)	1,5 PN	Test reference EN 1074-1
Seat tightness (test fluid: water)	1,1 PN	Test reference EN 1074-1

Final examination; Visual and dimensional check

Tests result without objection

118568.0005

Purchase order no. MAIL

Manufacturer's order confirmation no. 1.368 Dated 15/06/2021

Manufacturer's trade mark

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

Product VALV. GALL. MOD. ATHENA DN150 PN16

Quantity N. 1.0000

Serial no.

Tests

Shell strength (test fluid: water)	1,5 PN	Test reference EN 1074-1
Seat tightness (test fluid: water)	1,1 PN	Test reference EN 1074-1

Final examination; Visual and dimensional check

Tests result without objection

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

118568.0006

Purchase order no. MAIL

Manufacturer's order confirmation no. 1.368 Dated 15/06/2021

Manufacturer's trade mark

Product VALV. GALL. MOD. ATHENA DN200 PN16

Quantity N. 7,0000

Serial no.

Tests

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

Shell strength 1,5 PN Test reference EN 1074-1
(test fluid: water)

Seat tightness 1,1 PN Test reference EN 1074-1
(test fluid: water)

Final examination; Visual and dimensional check

Tests result without objection

118568.0007

Purchase order no. MAIL

Manufacturer's order confirmation no. 1.368 Dated 15/06/2021

Manufacturer's trade mark

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

Member of CISQ Federation

CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Test certificate

Customer VESCO WATER MATERIAL SUPPLY

Product VALV. GALL. MOD. ATHENA DN250 PN16

Quantity N. 2,0000

Serial no.

Tests

Shell strength (test fluid: water)	1,5 PN	Test reference EN 1074-1
Seat tightness (test fluid: water)	1,1 PN	Test reference EN 1074-1

Final examination; Visual and dimensional check

Tests result without objection

Salsomaggiore T., 17/08/2021

CSA s.r.l.

Quality control
manager

PHOTOS AND CATALOG

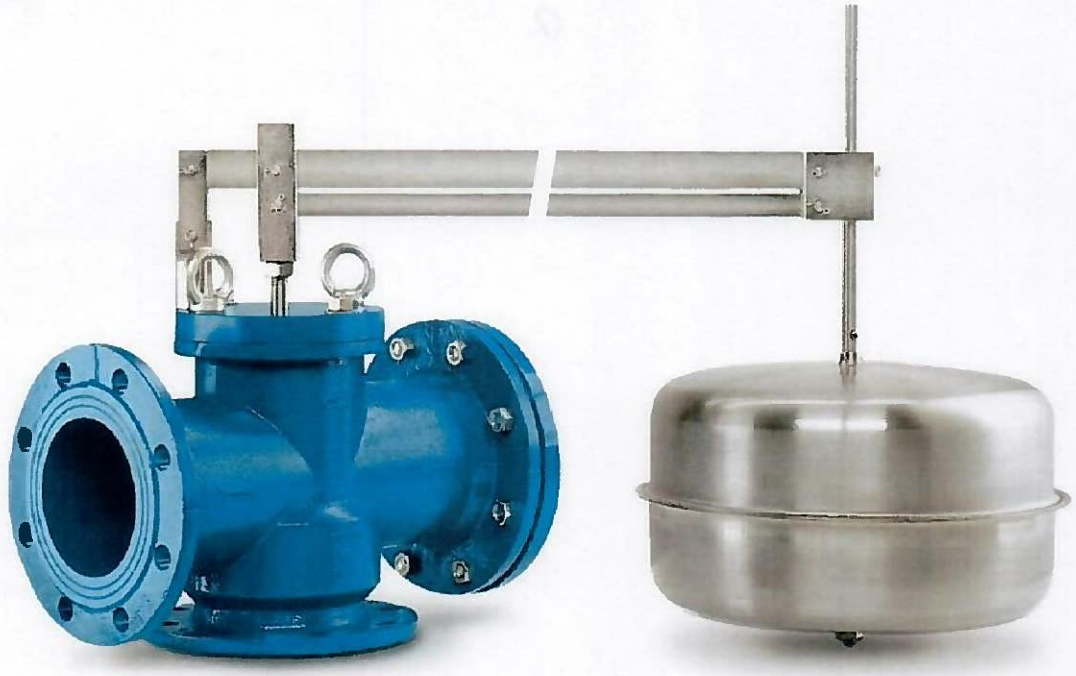
EQUIPMENT AND MATERIALS OF FLOATS VALVES


P16 SP2


P16 SP2

Equilibrium ball float valve with balanced single seat - Mod. ATHENA

The ATHENA is a single seat upstream pressure balanced equilibrium ball float valve, which automatically controls the constant level of a tank or reservoir, regardless of upstream pressure variations, and shuts off when the maximum level is reached. Thanks to its exclusive technology ATHENA brings the concept of reliability and performance to the highest standards.



Technical features and benefits

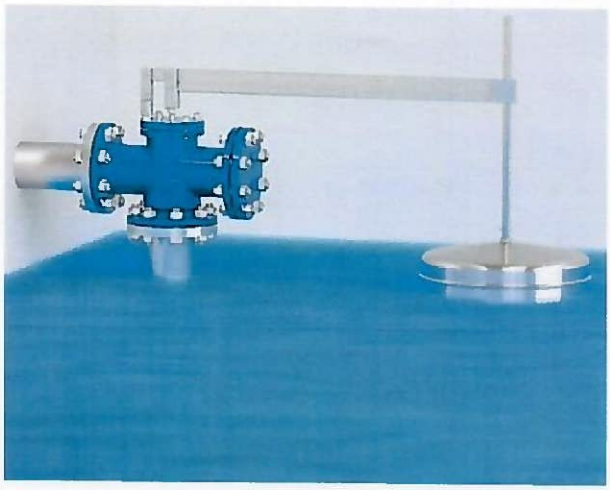
- Body in ductile cast iron with three ways, allowing the installation both with an angle or a globe pattern, containing an interchangeable sealing seat and piston in stainless steel and a guiding bush in bronze.
- Mobile block composed of the main shaft, obturator, gasket retainer and piston featuring a unique self-cleaning technology (pat. pending) to reduce the accumulation of dirt and maintenance operations.
- The lever mechanism, in zinc-plated or stainless steel, is obtained from a double rod (single rod for DN 40/50/65) which, by means of pivots, puts the shaft in communication with the float which imparts the movement allowing the opening or closing of the valve.
- A large float in stainless steel AISI 304/316 is connected to the lever mechanism by means of a stainless steel pipe, onto which it exerts a vertical force.
- The valves modulates and throttle the inflow proportionally to the consumption, accuracy and perfect water-tightness is guaranteed also with low pressure values.
- Thanks to the upstream pressure balanced seat the movement of the obturator and valve performance is not affected by upstream pressure fluctuations, transient and unwanted surges are therefore avoided.

Applications

- Water distribution systems.
- Fire protection storage tanks.
- Irrigation systems.
- Whenever the constant level regulation and control function is required.

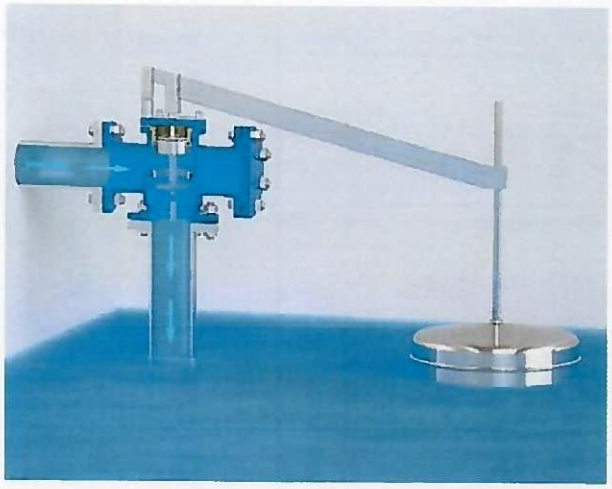
Operating principle - Angle pattern installation

Athena ball float valve is the best solution for a constant maximum level control balancing the inflow and outflow demand. Driven by a large float in stainless steel the valve closes drip-tight at the maximum level, and modulates to maintain it as soon as it drops due to consumptions.



Closed valve

When water level reaches the maximum operating point levers are perfectly horizontally aligned and the valve closes thanks to the upward force exerted by the float.

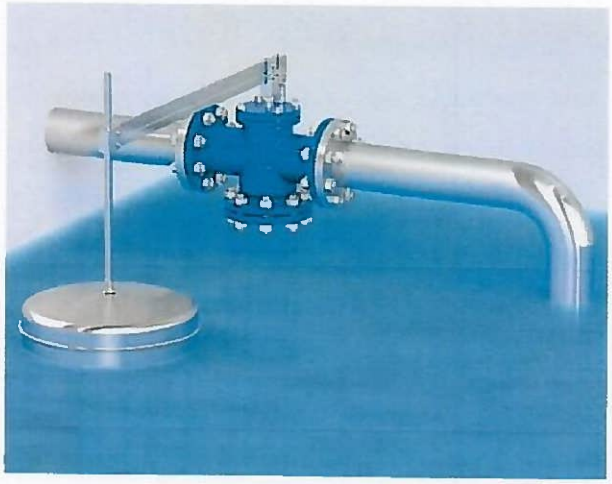


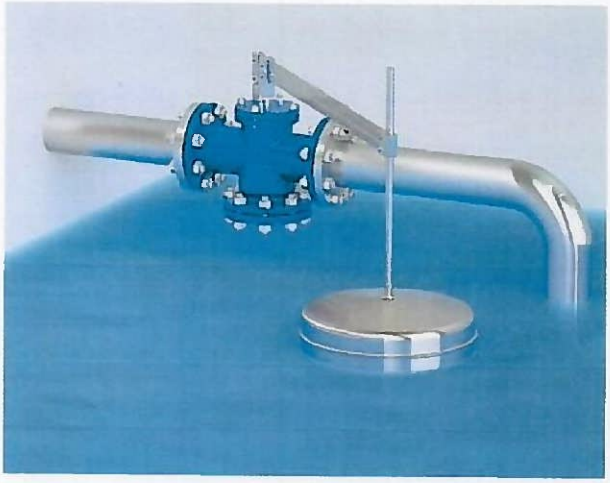
Opened valve

As the reservoir level drops the valve opens proportionally through the levers, receiving a downward force from the float, to increase the filling rate.

Globe pattern installation

The three ways body of Athena allows both the installations an angle and globe pattern, simply by placing the blank flange to the desired outlet. The lever mechanism is normally aligned with the valve axis. It is possible to rotate it on site, with an angle of 45°/90°, to fit the installation requirements.

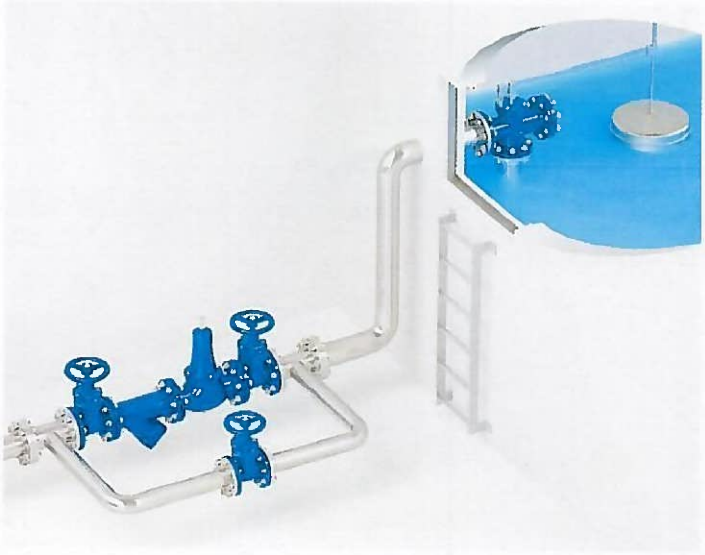




Optional

■ **Anti freezing device.** On request the valve is provided with a 3/8"G threaded outlet, which can be used as an anti-freezing device, simply by replacing the tap with a drainage ball valve discharging directly into the tank.
During the winter season, when the temperature drops consistently, the partial opening of the drainage port will create a flow circulation avoiding frost and possible damages related to it.

Technical data



Installation

- Make sure that the supply pipe has the flanges drilled according to the requested PN and that ATHENA is installed horizontally, properly fixed and sustained.
- Gate valves and filters have to be installed to allow for maintenance operations, and to prevent dirt from reaching the internal components of the valve.
- Position the valve in a place which is easy to reach and wide enough for maintenance and control purposes.
- Observe the overflow level and make sure that the outlet flange remains always above it, this is to avoid back-flow.
- In case of excessive Δp, to avoid cavitation and possible damages to the valve, a direct acting pressure reducing valve CSA VRCD series should be installed.

Working conditions

Fluid: treated water.
Maximum temperature: 70°C.
Maximum pressure: 16 bar; contact CSA for higher values.

Standard

Certified and tested in compliance with EN-1074/5.
Flanges according to EN 1092/2.
Epoxy painting applied through fluidized bed technology blue RAL 5005. Variations on flanges and painting on request.

DN mm	40	50	65	80	100	125	150	200	250	300
Kv (m^3/h)/bar	21,6	21,6	46,8	68,4	108	155	245	360	648	1008

Head loss coefficient for angle pattern

Kv coefficient representing the flow rate flowing through the valve fully open, and producing a head loss of 1 bar.

DN mm	40	50	65	80	100	125	150	200	250	300
Kv (m^3/h)/bar	18,4	18,4	39,6	59,4	90	133	209	313	576	864

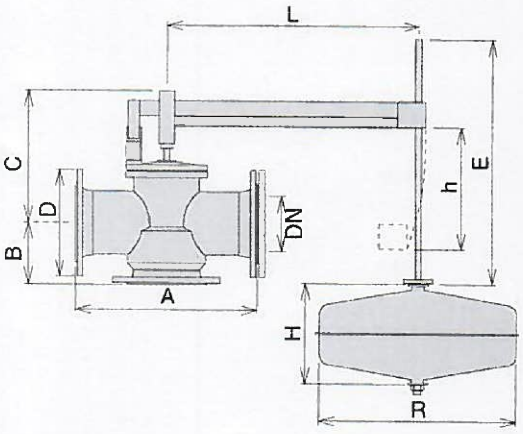
Head loss coefficient for globe pattern

Kv coefficient representing the flow rate flowing through the valve fully open, and producing a head loss of 1 bar.

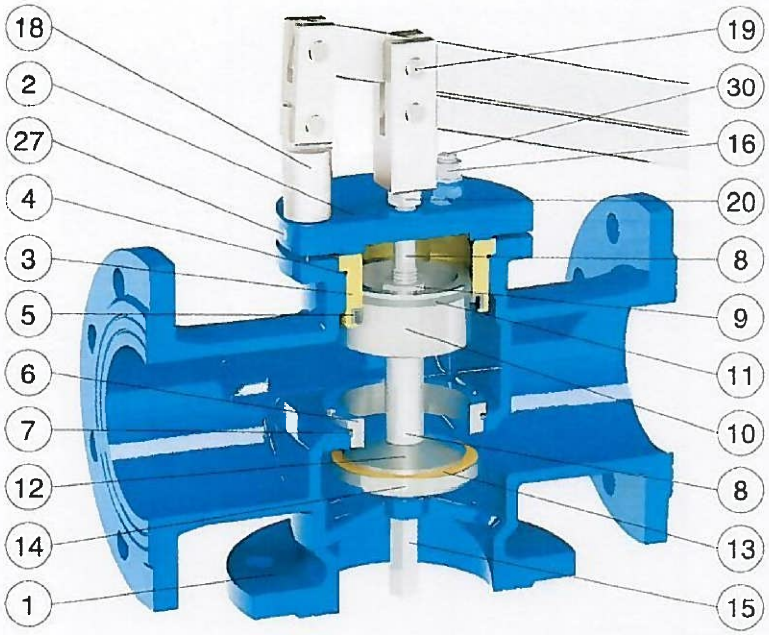
Weights and dimensions

DN mm	A mm	B mm	C mm	D mm	L mm	H mm	R mm	h mm	E mm	Wt Kg
40	230	82,5	183	165	600	Ø220		145	525	21
50	230	82,5	183	165	600	Ø220		145	525	21
65	290	92,5	197	185	600	Ø220		205	525	26
80	310	100	230	200	830	200	300	250	600	33
100	350	125	250	220	830	180	400	220	600	41
125	400	125	250	250	830	180	400	221	600	49
150	480	162	371	285	1000	250	400	400	540	79
200	600	183	420	340	1000	250	400	300	540	118
250	730	273	540	405	1220	300	500	510	945	215
300	850	300	620	460	1400	400	500	615	1042	250

All values are approximate, consult CSA service for more details.



Technical details

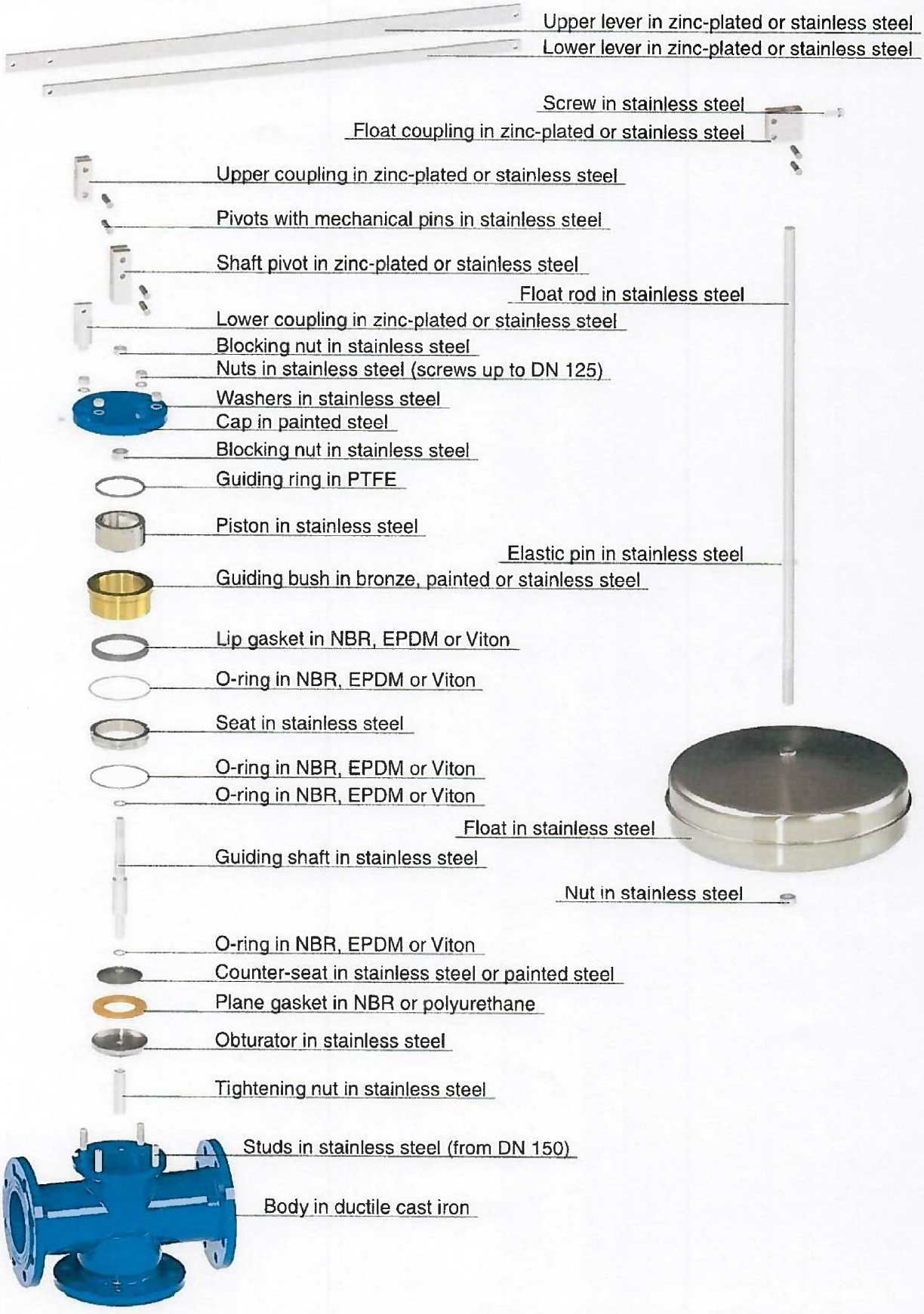


Athena DN 40/50-65

N.	Component	Standard material	Optional
1	Body	ductile cast iron GJS 450-10	
2	Cap	painted steel	
3	Guiding bushing	bronze CuSn5Zn5Pb5 (painted steel for DN 250-300)	stainless s. AISI 304/316
4	O-ring	NBR	EPDM/Viton
5	Lip gasket	NBR	EPDM/Viton
6	Seat	stainless steel AISI 304	stainless steel AISI 316
7	O-ring	NBR	EPDM/Viton
8	Guiding shaft	stainless steel AISI 303	stainless steel AISI 316
9	Blocking nut	stainless steel AISI 304	stainless steel AISI 316
10	Piston	stainless steel AISI 303	stainless steel AISI 316
11	Guiding ring	PTFE	
12	Counter-seat	stainless s. AISI 303 (painted steel for DN 250-300)	stainless s. AISI 304/316
13	Plane gasket	NBR	polyurethane
14	Obturator	stainless s. AISI 303 (AISI 304 for DN 200-250-300)	stainless steel AISI 316
15	Tightening nut	stainless steel AISI 303	stainless steel AISI 316
16	Nuts (or screws) and washers	stainless steel AISI 304	stainless steel AISI 316
17	Upper coupling	zinc-plated steel	stainless s. AISI 304/316
18	Lower coupling	zinc-plated steel	stainless s. AISI 304/316
19	Pivots	stainless steel AISI 303	stainless steel AISI 316
20	Blocking nut	stainless steel AISI 304	stainless steel AISI 316
21	Shaft pivot	zinc-plated steel	stainless s. AISI 304/316
22	Upper lever	zinc-plated steel	stainless s. AISI 304/316
23	Lower lever (from DN 80)	zinc-plated steel	stainless s. AISI 304/316
24	Float coupling (from DN 80)	zinc-plated steel	stainless s. AISI 304/316
25	Float rod	stainless steel AISI 304	stainless steel AISI 316
26	Float	stainless steel AISI 304	stainless steel AISI 316
27	Plug (screw from DN 150 to 300)	stainless steel AISI 304	stainless steel AISI 316
28	Elastic pin (from DN 80)	stainless steel AISI 304	
29	Screw	stainless steel AISI 304	stainless steel AISI 316
30	Studs (from DN 150 to 300)	stainless steel AISI 304	stainless steel AISI 316

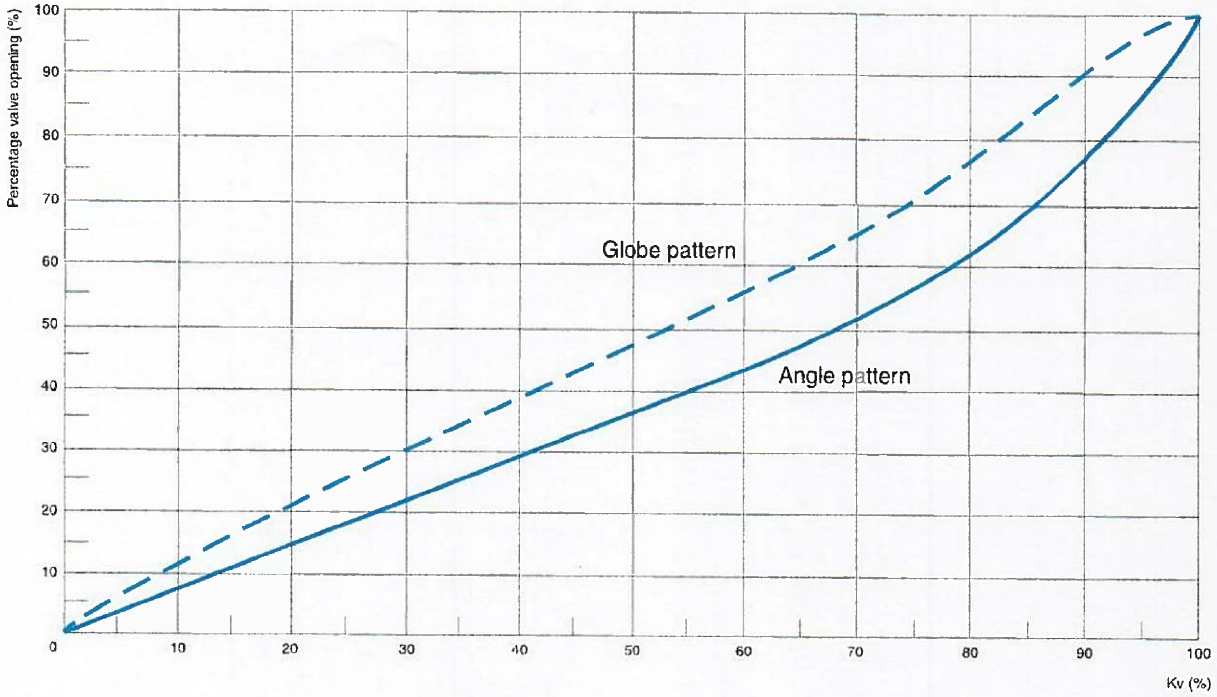
The list of materials and components is subject to changes without notice.

Spare parts breakdown



Kv to valve opening chart

The following chart shows the opening percentage of Athena valves versus the Kv.



Recommended flow rate

The following chart shows the recommended flow rate for the proper sizing of Athena valves.

Athena - angle pattern

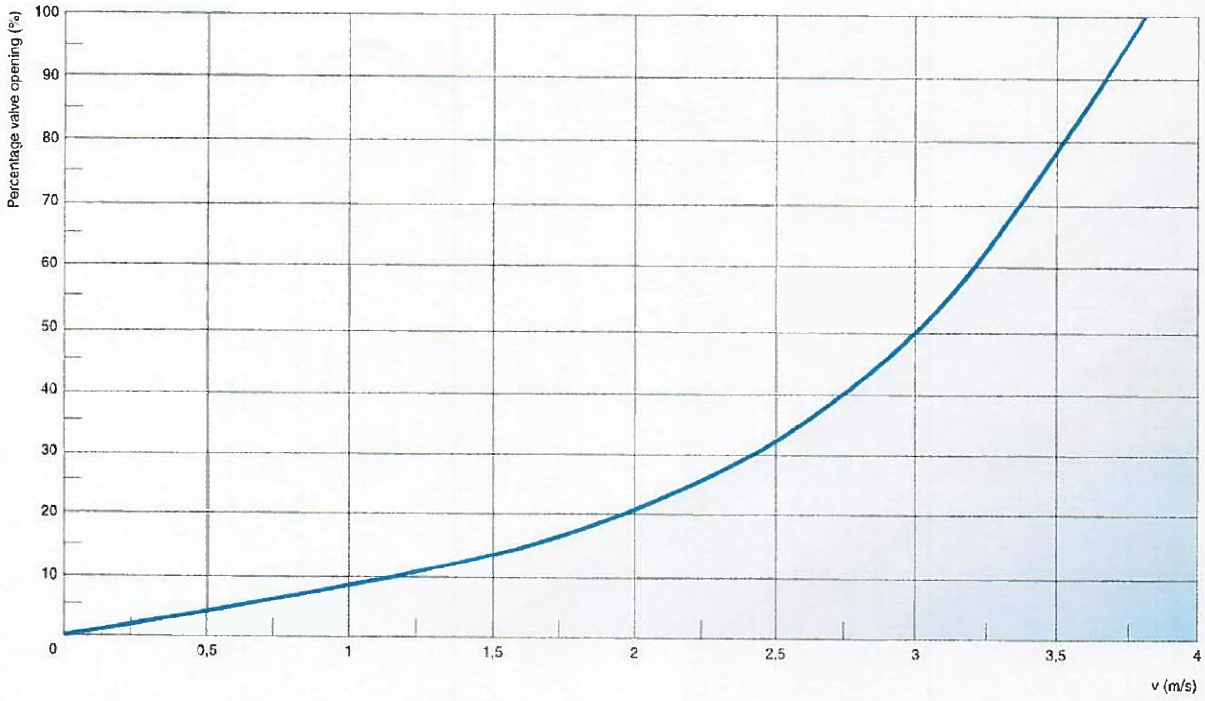
DN (mm)	40/50	65	80	100	125	150	200	250	300
Flow rate min. (l/s)	0,3	0,5	0,8	1,2	1,9	2,7	4,8	7,4	11
Flow rate max. (l/s)	6,4	10	16	25	40	58	103	161	233
Emergency (l/s)	7,8	13	20	31	49	70	125	196	282

Athena - globe pattern

DN (mm)	40/50	65	80	100	125	150	200	250	300
Flow rate min. (l/s)	0,4	0,7	1,1	1,6	2,5	3,6	6,3	9,9	15
Flow rate max. (l/s)	5,1	8,6	13	20	31	45	81	127	183
Emergency (l/s)	6,4	10	16	25	40	58	103	161	233

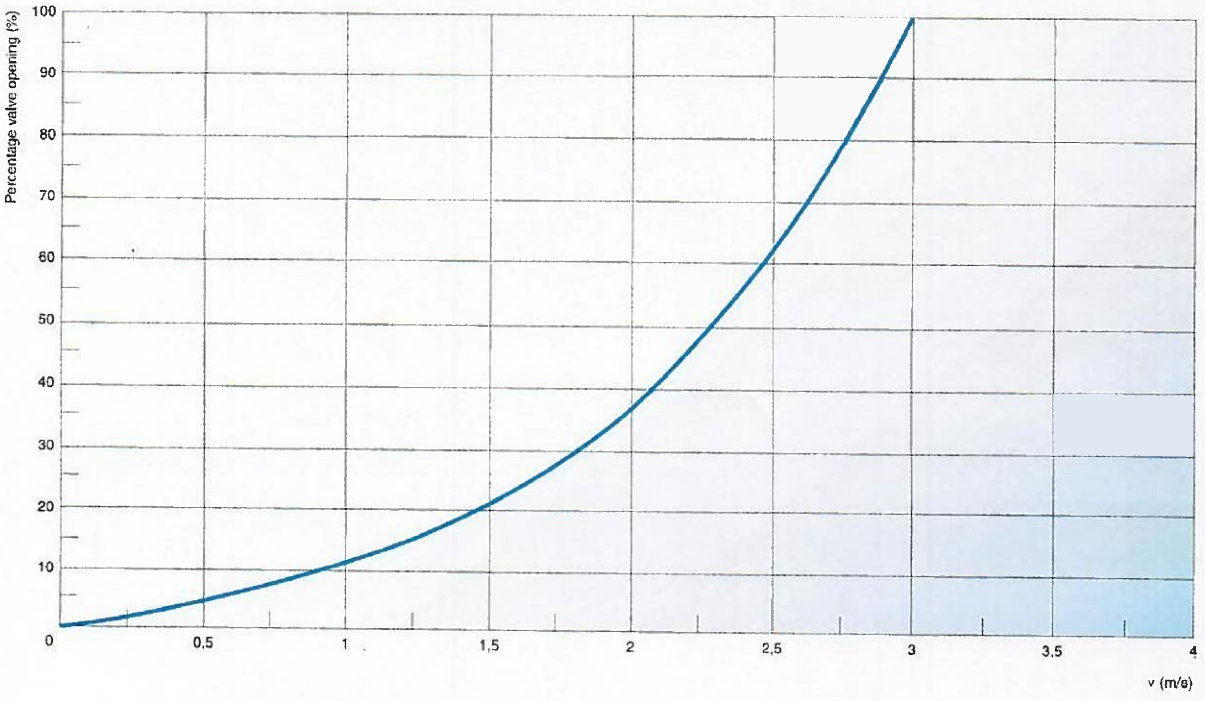
Velocity chart to opening - Angle pattern

The following chart shows the maximum recommended velocity, versus opening percentage, to avoid cavitation.



Velocity chart to opening - Globe pattern

The following chart shows the maximum recommended velocity, versus opening percentage, to avoid cavitation.



5 . PHOTOCOPY MACHINE

ALPHA COMPUTER LTD

IT/AUDIO/VISUAL SUPPLY & SERVICES
TIN/VAT No. 100480628
Tél.: 0788304366 / 0788523788
E-mail.:sales@alphacomputerltd.com
www.alphacomputerltd.com

PROFORMA INVOICE № 3247 / 20

CLIENT IDENTIFICATION
Names: KYOWA ENGINEERING
Address: CONSULTANTS Co. Ltd

QUOTATION
DATE: 22/8/2016

QTY	TECHNICAL SPECIFICATONS	UNIT PRICE	TOTAL
1	CANON IMAGERUNNER IR2202N	650,000	650,000
	with DADF	550,000	550,000
	Duplex	400,000	400,000
	Tray (double)	450,000	450,000
	Stand	250,000	250,000

NOTICE:
Payment : .....
VAT: Included
Delivery Period: In Stock
Warranty: 1 Year

TOTAL : 2,300,000
VAT (18%) : Included
Grand TOTAL: 2,300,000

BANK OF KIGALI account No. 040-0205994-96 (2800 USD)


Canon
imageRUNNER
2202N


Canon
JICA
imageRUNNER
3202N

Attachment 5: Cost-Benefit Analysis

Cost-benefit Analysis of NRW Reduction Measures of Pilot Project

The cost-benefit analysis to evaluate the outcome of the NRW reduction measures which were implemented in the pilot projects of Kadbogo and Ruyenzi were conducted. The result is as shown below.

1. Used Data

Application periods of the data used for cost-benefit analysis are as the table shown below.

Table 1 Period of the Cost-benefit Analysis of the Pilot Project

Pilot Area	Baseline	NRW Reduction Activity Implementation Period 1st Year	Effect Evaluation Period of NRW Reduction Activity 2nd Year
Kadobogo	Jun, July 2017	Apr. 2018～Mar. 2019	Apr. 2019～Mar. 2020
Ruyenzi	Mar. Apr. 2018	Oct. 2018～Sept. 201	Oct. 2019～Mar. 202

2. Monthly change in volume of Distribution, Billing and NRW

By using the actual data of distribution, billing and NRW of the Pilot areas, NRW rate was calculated. Monthly change of these values are shown as in the table below.

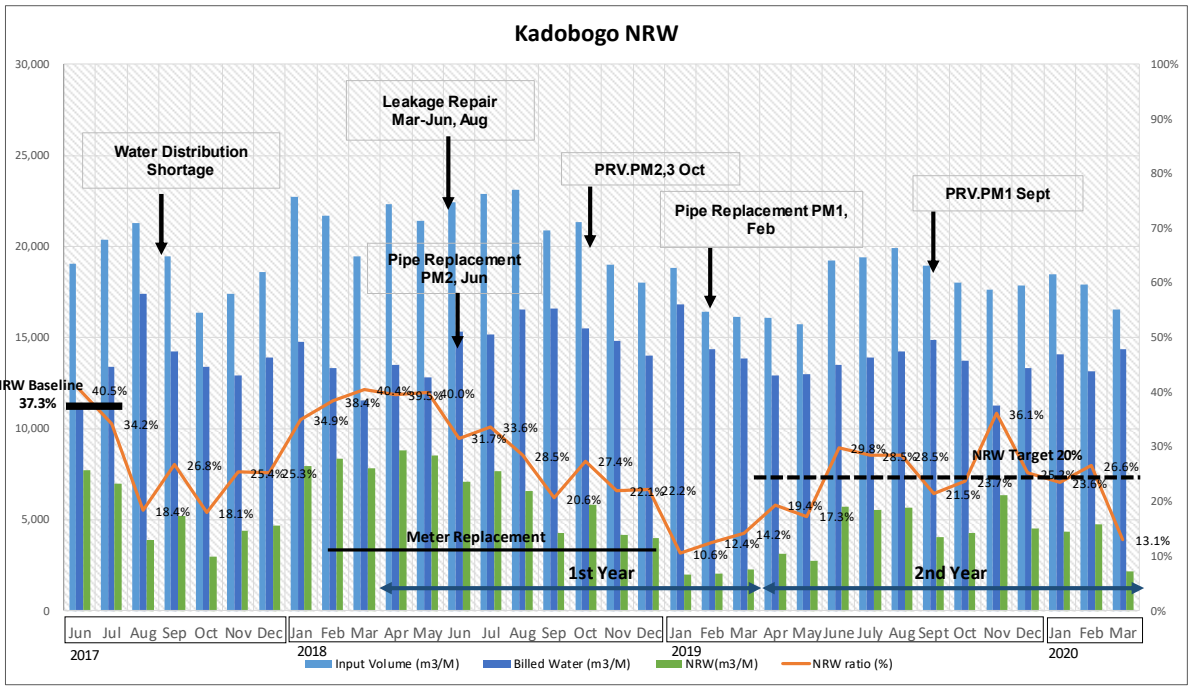


Fig.1 Monthly change of NRW volume in Kadobogo

Kadobogo NRW Rate

Item	2017							2018												2019												2020		
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Input Volume (m3/M)	19,054	20,389	21,279	19,466	16,350	17,366	18,609	22,694	21,677	19,439	22,328	21,373	22,445	22,862	23,138	20,913	21,358	18,991	18,000	18,800	16,408	16,120	16,059	15,712	19,227	19,404	19,885	18,956	18,012	17,633	17,843	18,456	17,911	16,561
Billed Water (m3/M)	11,345	13,412	17,374	14,246	13,397	12,959	13,908	14,765	13,351	11,579	13,499	12,822	15,340	15,175	16,541	16,595	15,496	14,792	14,000	16,816	14,367	13,834	12,939	12,986	13,492	13,880	14,221	14,877	13,736	11,265	13,342	14,100	13,143	14,388
NRW(m3/M)	7,709	6,977	3,905	5,220	2,953	4,407	4,701	7,929	8,326	7,860	8,829	8,551	7,105	7,687	6,597	4,318	5,862	4,199	4,000	1,984	2,041	2,286	3,120	2,726	5,735	5,524	5,664	4,079	4,276	6,368	4,501	4,356	4,768	2,173
NRW ratio (%)	40.5%	34.2%	18.4%	26.8%	18.1%	25.4%	25.3%	34.9%	38.4%	40.4%	39.5%	40.0%	31.7%	33.6%	28.5%	20.6%	27.4%	22.1%	22.2%	10.6%	12.4%	14.2%	19.4%	17.3%	29.8%	28.5%	28.5%	21.5%	23.7%	36.1%	25.2%	23.6%	26.6%	13.1%
POC	1,308	1,312	1,330	1,335	1,335	1,338	1,343	1,351	1,358	1,302	1,306	1,306	1,307	1,307	1,322	1,325	1,326	1,326	1,326	1,353	1,355	1,358	1,359	1,360	1,363	1,363	1,366	1,422	1,422	1,422	1,422	1,429	1,429	1,429

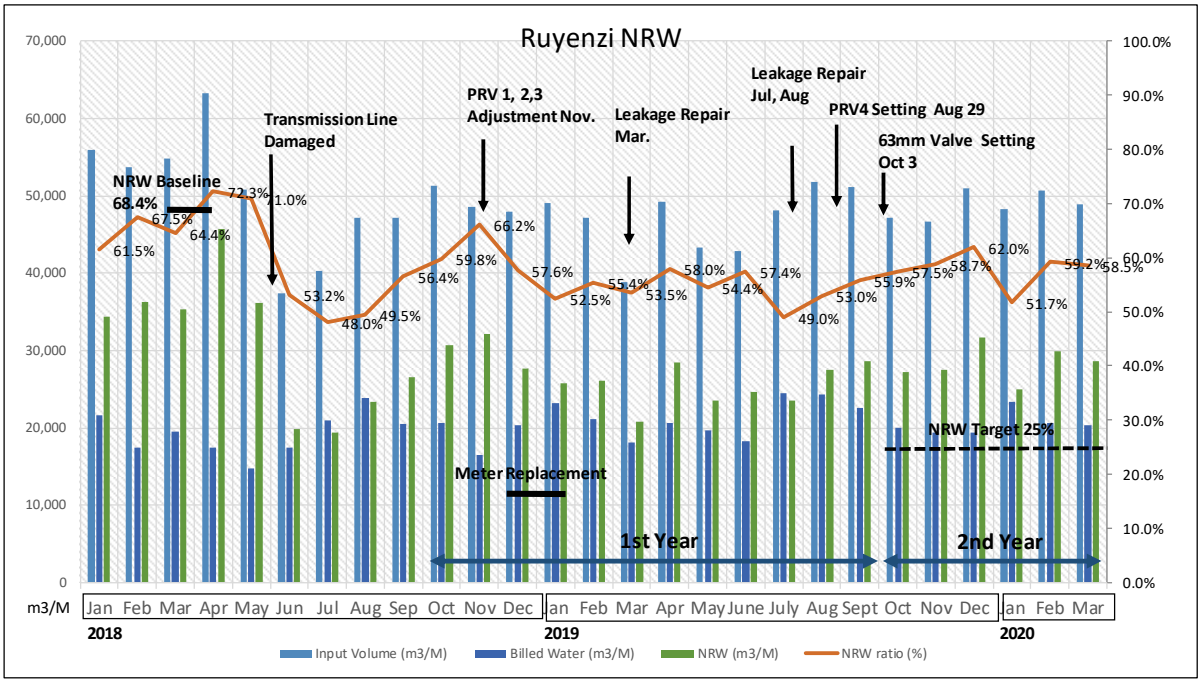


Fig.2 Monthly change of NRW volume in Ruyenzi

Ruyenzi NRW

Item	2018												2019												2020		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Input Volume (m3/M)	55,992	53,704	54,812	63,327	50,826	37,437	40,226	47,153	47,161	51,242	48,539	47,923	49,026	47,189	38,875	49,156	43,285	42,917	48,084	51,863	51,135	47,168	46,755	50,999	48,312	50,589	48,916
Billed Water (m3/M)	21,574	17,441	19,486	17,540	14,753	17,520	20,910	23,820	20,543	20,588	16,427	20,304	23,271	21,055	18,094	20,662	19,722	18,264	24,518	24,397	22,571	20,030	19,306	19,392	23,326	20,651	20,283
NRW (m3/M)	34,418	36,263	35,326	45,787	36,073	19,917	19,316	23,333	26,618	30,654	32,112	27,619	25,755	26,134	20,781	28,494	23,563	24,653	23,566	27,466	28,564	27,138	27,449	31,607	24,986	29,938	28,633
NRW ratio (%)	61.5%	67.5%	64.4%	72.3%	71.0%	53.2%	48.0%	49.5%	56.4%	59.8%	66.2%	57.6%	52.5%	55.4%	53.5%	58.0%	54.4%	57.4%	49.0%	53.0%	55.9%	57.5%	58.7%	62.0%	51.7%	59.2%	58.5%
POC	1,459	1,514	1,572	1,575	1,581	1,585	1,590	1,598	1,618	1,616	1,623	1,629	1,664	1,674	1,675	1,715	1,739	1,743	1,748	1,799	1,847	1,847	1,892	1,894	1,902	1,902	1,910

3. Analysis of Distribution, Billing and NRW volume

The result of the analysis to know the tendency of monthly change of distribution, billing and NRW by using the data for three years (36 months) from July, 2017 in Kigali city (total 6 branches) shows as follows.

In the monthly change of distribution and billing, there is a tendency to increases in the dry season (from December to February, from June to September) and to decrease in the rainy season (from March to May, from October to November). Variation amount of these are about within ±15% to the mean amount. NRW has some time lag to these, and variation amount is about within ±30% to the mean.

Distribution volume of 2017/18 had less quantity as shown in Fig. 4, and there were only 87% against to 2019/20. Particularly, there was few during from September to November of 2017. The amount of the volume 2018/19 was almost the same as that of 2019/20. It was 97% of 2019/20.

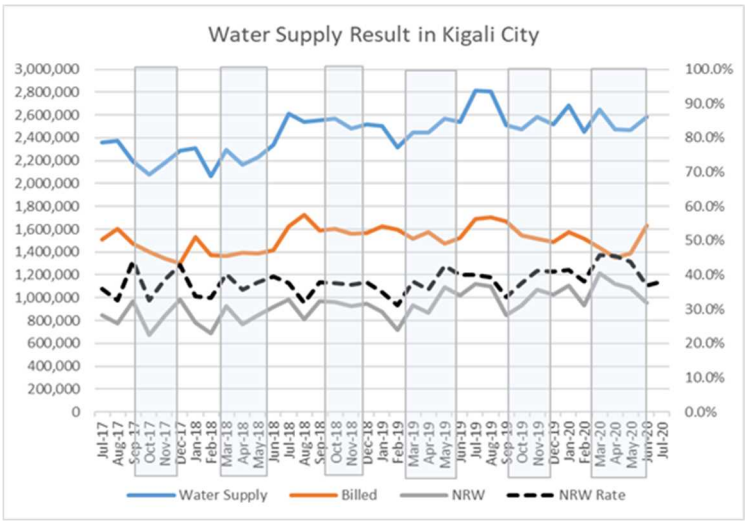


Fig.3 Monthly Change and Seasonal Tendency

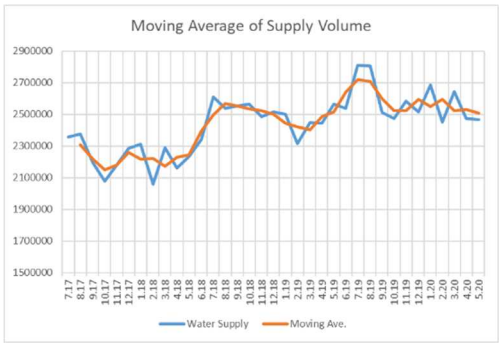
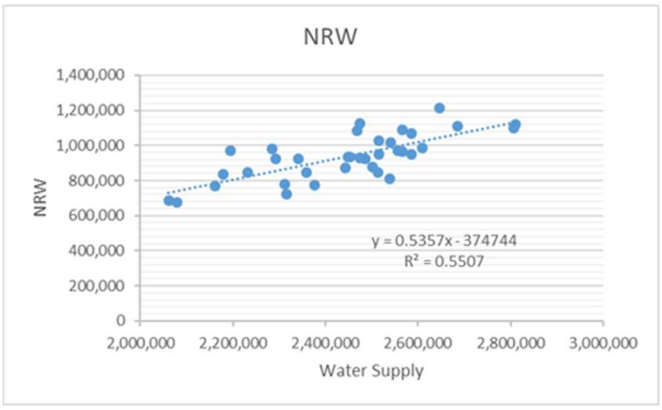
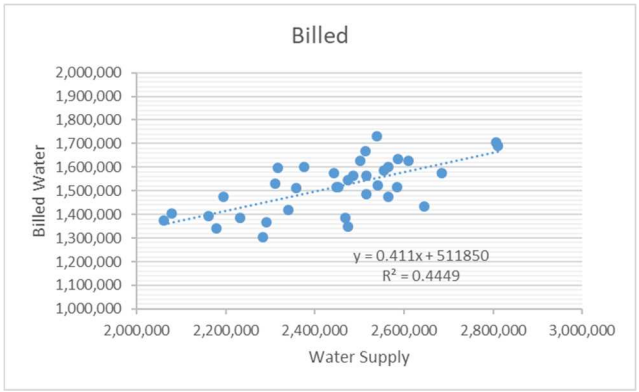


Fig.4 Yearly Change of Distribution

The result of the analysis on correlation of distribution, billing and NRW is as shown in figure 5. As for the coefficient of determination (R^2) indicating the correlative degree, in the case between distribution and NRW R^2 is 0.55, in the case between distribution and billing R^2 is 0.44. It may be said that there is slightly strong correlation in both of them, but there is stronger correlation between distribution and NRW. From this, it is thought that the distribution more often becomes the NRW (leakage) than it is used for billing





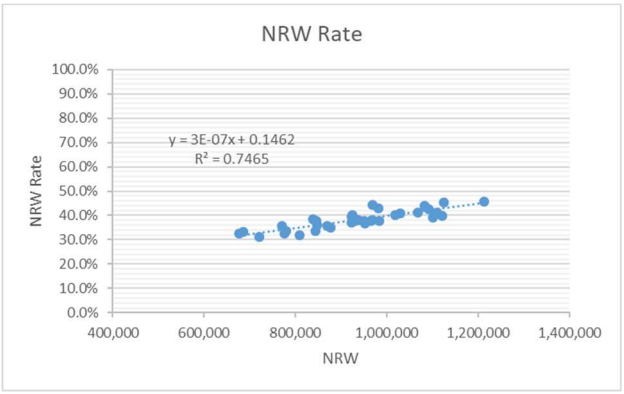


Fig. 5 Correlation Chart

Table 2 Actual Data of Distribution, Billing and NRW

NRW Data in Kigali City (2017/18, 2018/19, 2019/20)

No	Month	Water Supply	Billed	NRW	NRW Rate	Base Month	
		m3/M	m3/M	m3/M	%	2018 Aug	2018 Oct
						Kadobogo	Ruyenzi
1	Jul-17	2,358,680	1,510,843	847,837	35.9%	0.93	0.92
2	Aug-17	2,376,386	1,600,843	775,543	32.6%	0.94	0.93
3	Sep-17	2,195,068	1,473,615	969,269	44.2%	0.86	0.86
4	Oct-17	2,079,164	1,403,414	675,750	32.5%	0.82	0.81
5	Nov-17	2,178,763	1,340,409	838,354	38.5%	0.86	0.85
6	Dec-17	2,284,467	1,302,878	981,589	43.0%	0.90	0.89
7	Jan-18	2,311,169	1,532,376	778,793	33.7%	0.91	0.90
8	Feb-18	2,060,830	1,374,943	685,887	33.3%	0.81	0.80
9	Mar-18	2,291,706	1,367,840	923,866	40.3%	0.90	0.89
10	Apr-18	2,161,958	1,391,955	770,003	35.6%	0.85	0.84
11	May-18	2,231,670	1,385,750	845,920	37.9%	0.88	0.87
12	Jun-18	2,341,374	1,418,975	922,399	39.4%	0.92	0.91
1	Jul-18	2,609,608	1,625,699	983,909	37.7%	1.03	1.02
2	Aug-18	2,538,594	1,729,371	809,223	31.9%	1.00	0.99
3	Sep-18	2,555,684	1,586,416	969,269	37.9%	1.01	1.00
4	Oct-18	2,565,587	1,600,730	964,857	37.6%	1.01	1.00
5	Nov-18	2,485,742	1,562,443	923,299	37.1%	0.98	0.97
6	Dec-18	2,515,148	1,564,529	950,619	37.8%	0.99	0.98
7	Jan-19	2,502,266	1,626,131	876,135	35.0%	0.99	0.98
8	Feb-19	2,316,598	1,596,598	720,000	31.1%	0.91	0.90
9	Mar-19	2,449,216	1,515,130	934,086	38.1%	0.96	0.95
10	Apr-19	2,443,376	1,573,394	869,982	35.6%	0.96	0.95
11	May-19	2,565,468	1,474,321	1,091,147	42.5%	1.01	1.00
12	Jun-19	2,540,638	1,521,733	1,018,905	40.1%	1.00	0.99
1	Jul-19	2,811,212	1,689,917	1,121,295	39.9%	1.11	1.10
2	Aug-19	2,806,071	1,704,621	1,101,450	39.3%	1.11	1.09
3	Sep-19	2,513,517	1,669,415	844,102	33.6%	0.99	0.98
4	Oct-19	2,475,008	1,544,615	930,393	37.6%	0.97	0.96
5	Nov-19	2,584,878	1,517,522	1,067,356	41.3%	1.02	1.01
6	Dec-19	2,515,026	1,486,404	1,028,622	40.9%	0.99	0.98
7	Jan-20	2,684,663	1,575,257	1,109,406	41.3%	1.06	1.05
8	Feb-20	2,452,569	1,515,954	936,615	38.2%	0.97	0.96
9	Mar-20	2,646,035	1,434,066	1,211,969	45.8%	1.04	1.03
10	Apr-20	2,474,498	1,350,338	1,124,160	45.4%	0.97	0.96
11	May-20	2,468,747	1,386,123	1,082,624	43.9%	0.97	0.96
12	Jun-20	2,585,776	1,634,374	951,402	36.8%	1.02	1.01
	Average	2,443,810	1,516,359	934,334	38.1%		
	Max	1.15	1.14	1.30	1.2		
	Min	0.84	0.86	0.72	0.8		

4. Effect Volume of Pilot Project (Reduction Volume of NRW)

1) Evaluation method of the effect volume

Following two methods are considered as an evaluation method of the reduction volume produced by NRW reduction activities.

Method 1: Integration volume from baseline to evaluation (Without Project–With Project)

Method 2: Difference of volume between baseline and the reached (Before Project–After Project)

The calculation result of effect volume in both project of Kadobogo and Ruyenzi are shown as follows. As a result, a gap between 1.2-1.9 times occurred by method 1 and method 2. Method 2 is simple and easy as calculation technique, but a change of the volume from the baseline setting month to the evaluation month is not considered. Therefore, method 1 was decided to use in this report.

2) Effect volume of Kadobogo

Table 3 Calculation result of effect volume by Method 1 (Kadobogo)

Water Volume (m3/month)

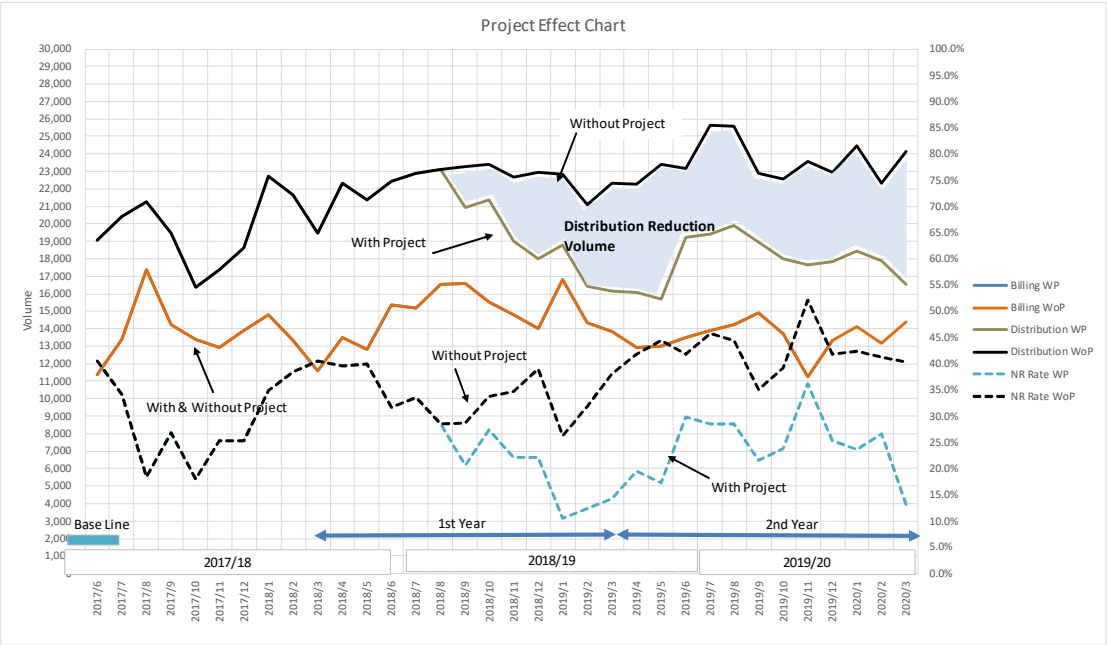
Year/Month	Billing WP	Billing WoP	Distribution WP	Distribution WoP	NR Rate WP	NR Rate WoP	NRW WP	NRW WoP	Reduction
2017/6	11,345	11,345	19,054	19,054	40.5%	40.5%	7,709	7,709	0
2017/7	13,412	13,412	20,389	20,389	34.2%	34.2%	6,977	6,977	0
2017/8	17,374	17,374	21,279	21,279	18.4%	18.4%	3,905	3,905	0
2017/9	14,246	14,246	19,466	19,466	26.8%	26.8%	5,220	5,220	0
2017/10	13,397	13,397	16,350	16,350	18.1%	18.1%	2,953	2,953	0
2017/11	12,959	12,959	17,366	17,366	25.4%	25.4%	4,407	4,407	0
2017/12	13,908	13,908	18,609	18,609	25.3%	25.3%	4,701	4,701	0
2018/1	14,765	14,765	22,694	22,694	34.9%	34.9%	7,929	7,929	0
2018/2	13,351	13,351	21,677	21,677	38.4%	38.4%	8,326	8,326	0
2018/3	11,579	11,579	19,439	19,439	40.4%	40.4%	7,860	7,860	0
2018/4	13,499	13,499	22,328	22,328	39.5%	39.5%	8,829	8,829	0
2018/5	12,822	12,822	21,373	21,373	40.0%	40.0%	8,551	8,551	0
2018/6	15,340	15,340	22,445	22,445	31.7%	31.7%	7,105	7,105	0
2018/7	15,175	15,175	22,862	22,862	33.6%	33.6%	7,687	7,687	0
2018/8	16,541	16,541	23,138	23,138	28.5%	28.5%	6,597	6,597	0
2018/9	16,595	16,595	20,913	23,294	20.6%	28.8%	4,318	6,699	2,381
2018/10	15,496	15,496	21,358	23,384	27.4%	33.7%	5,862	7,888	2,026
2018/11	14,792	14,792	18,991	22,656	22.1%	34.7%	4,199	7,864	3,665
2018/12	14,000	14,000	18,000	22,924	22.2%	38.9%	4,000	8,924	4,924
2019/1	16,816	16,816	18,800	22,807	10.6%	26.3%	1,984	5,991	4,007
2019/2	14,367	14,367	16,408	21,115	12.4%	32.0%	2,041	6,748	4,707
2019/3	13,834	13,834	16,120	22,323	14.2%	38.0%	2,286	8,489	6,203
2019/4	12,939	12,939	16,059	22,270	19.4%	41.9%	3,120	9,331	6,211
2019/5	12,986	12,986	15,712	23,383	17.3%	44.5%	2,726	10,397	7,671
2019/6	13,492	13,492	19,227	23,157	29.8%	41.7%	5,735	9,665	3,930
2019/7	13,880	13,880	19,404	25,623	28.5%	45.8%	5,524	11,743	6,219
2019/8	14,221	14,221	19,885	25,576	28.5%	44.4%	5,664	11,355	5,691
2019/9	14,877	14,877	18,956	22,909	21.5%	35.1%	4,079	8,032	3,953
2019/10	13,736	13,736	18,012	22,558	23.7%	39.1%	4,276	8,822	4,546
2019/11	11,265	11,265	17,633	23,560	36.1%	52.2%	6,368	12,295	5,927
2019/12	13,342	13,342	17,843	22,923	25.2%	41.8%	4,501	9,581	5,080
2020/1	14,100	14,100	18,456	24,469	23.6%	42.4%	4,356	10,369	6,013
2020/2	13,143	13,143	17,911	22,354	26.6%	41.2%	4,768	9,211	4,443
2020/3	14,388	14,388	16,561	24,117	13.1%	40.3%	2,173	9,729	7,556

5,603

Note, WP: With Project, WoP: Without Project

Reduction of NRW Rate: Kadobogo

Time		NRE Rate %		Reduction %		Reduction/Baseline %	
Baseline		37.3					
Target		20.0		17.3		46%	
Result	18/19 Q4	22.2	24.5	15.1	12.8	40%	34%
	19/20 Q1	26.2		11.1		30%	
	19/20 Q2	28.4		8.9		24%	
	19/20 Q3	21.1		16.2		43%	



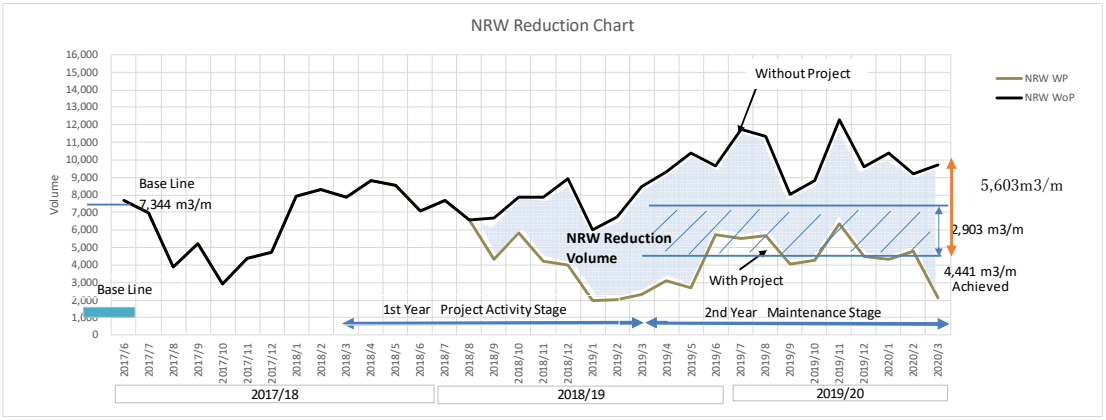


Fig. 6 Change of the Effect Volume (Kadobogo)

The reduction volume is 2,903m3/month as shown in a table below when it was assumed that the differences between baseline and reached (2nd Year) after NRW reduction measures were implemented. On the other hand, the mean of the volume of integral calculus to show in Fig. 6 becomes 5,603 m3/month. Both have a gap between 1.9 times.

Table 4 Calculation result of effect volume by Method 2 (Kadobogo)

Kadobogo Pilot Area

Item	NRW Rate	Input	Billing	NRW
	%	m3/Month	m3/Month	m3/Month
Baseline	37.3	19,722	12,378	7,344
Achievement	24.5	17,972	13,531	4,441
Reduction	12.8	1,750	-1,153	2,903
Reduction Rate	34%	9%	-9%	40%

3) Effect volume of Ruyenzi

Table 5 Calculation result of effect volume by Method 1(Ruyenzi)

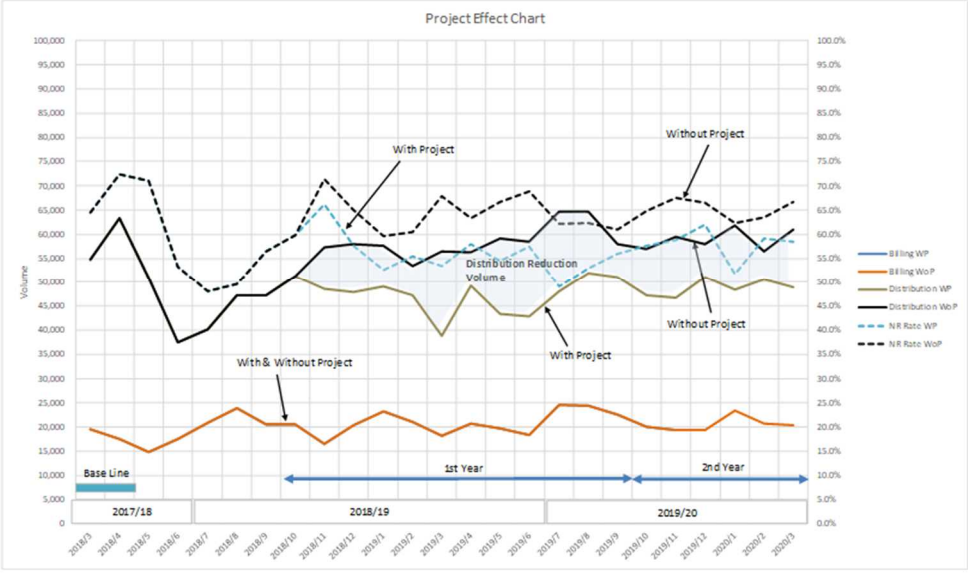
Water Volume (m3/month)

	Year/Month	Billing WP	Billing WoP	Distribution WP	Distribution WoP	NR Rate WP	NR Rate WoP	NRW WP	NRW WoP	Reduction	
	2018/3	19,486	19,486	54,812	54,812	64.4%	64.4%	35,326	35,326	0	
	2018/4	17,540	17,540	63,327	63,327	72.3%	72.3%	45,787	45,787	0	
	2018/5	14,753	14,753	50,826	50,826	71.0%	71.0%	36,073	36,073	0	
	2018/6	17,520	17,520	37,437	37,437	53.2%	53.2%	19,917	19,917	0	
	2018/7	20,910	20,910	40,226	40,226	48.0%	48.0%	19,316	19,316	0	
	2018/8	23,820	23,820	47,153	47,153	49.5%	49.5%	23,333	23,333	0	
	2018/9	20,543	20,543	47,161	47,161	56.4%	56.4%	26,618	26,618	0	
1	2018/10	20,588	20,588	51,242	51,242	59.8%	59.8%	30,654	30,654	0	
2	2018/11	16,427	16,427	48,539	57,231	66.2%	71.3%	32,112	40,804	8,692	
3	2018/12	20,304	20,304	47,923	57,908	57.6%	64.9%	27,619	37,604	9,985	
4	2019/1	23,271	23,271	49,026	57,612	52.5%	59.6%	25,755	34,341	8,586	
5	2019/2	21,055	21,055	47,189	53,337	55.4%	60.5%	26,134	32,282	6,148	
6	2019/3	18,094	18,094	38,875	56,390	53.5%	67.9%	20,781	38,296	17,515	
7	2019/4	20,662	20,662	49,156	56,256	58.0%	63.3%	28,494	35,594	7,100	
8	2019/5	19,722	19,722	43,285	59,067	54.4%	66.6%	23,563	39,345	15,782	
9	2019/6	18,264	18,264	42,917	58,495	57.4%	68.8%	24,653	40,231	15,578	
10	2019/7	24,518	24,518	48,084	64,725	49.0%	62.1%	23,566	40,207	16,641	
11	2019/8	24,397	24,397	51,863	64,606	53.0%	62.2%	27,466	40,209	12,743	
12	2019/9	22,571	22,571	51,135	57,871	55.9%	61.0%	28,564	35,300	6,736	
1	2019/10	20,030	20,030	47,168	56,984	57.5%	64.8%	27,138	36,954	9,816	
2	2019/11	19,306	19,306	46,755	59,514	58.7%	67.6%	27,449	40,208	12,759	
3	2019/12	19,392	19,392	50,999	57,905	62.0%	66.5%	31,607	38,513	6,906	
4	2020/1	23,326	23,326	48,312	61,811	51.7%	62.3%	24,986	38,485	13,499	
5	2020/2	20,651	20,651	50,589	56,467	59.2%	63.4%	29,938	35,816	5,878	
6	2020/3	20,283	20,283	48,916	60,922	58.5%	66.7%	28,633	40,639	12,006	10,144

Note, WP: With Project, WoP: Without Project

Reduction of NRW Rate: Ruyenzi

Time		NRE Rate %		Reduction %		Reduction/Baseline %	
Baseline		68.4					
Target		25.0		43.4		63%	
Result	19/20 Q2	59.4	57.9	9.0	10.5	13%	15%
	19/20 Q3	56.4		12.0		18%	



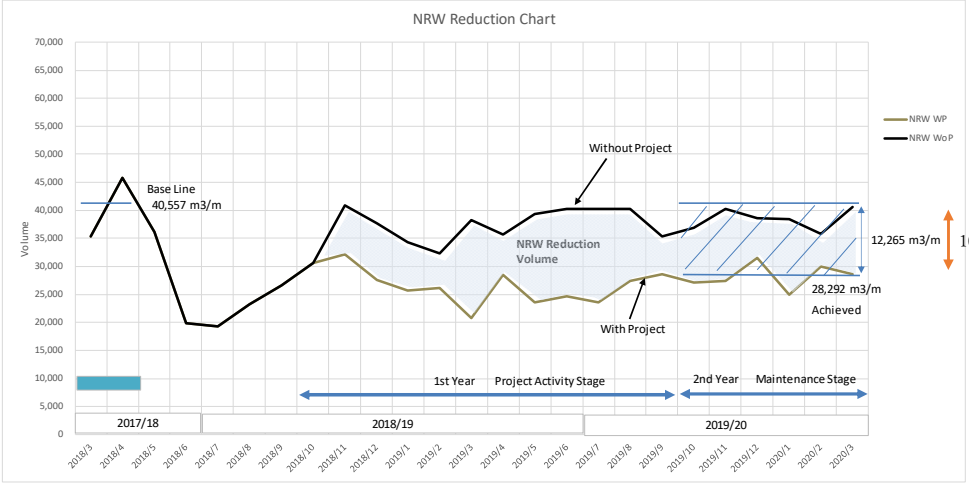


Fig. 7 Change of the Effect Volume (Ruyenzi)

The reduction volume is 12,265 m3/month as shown in a table below when it was assumed that the differences between baseline and reached (2nd Year) after NRW reduction measures were implemented. On the other hand, the mean of the volume of integral calculus to show in Fig. 6 becomes 10,144 m3/month. Both have a gap between 1.2 times.

Table 6 Calculation result of effect volume by Method 2 (Ruyenzi)

Ruyenzi Pilot Area

Item	NRW Rate	Input	Billing	NRW
	%	m3/m	m3/m	m3/m
Baseline	68.4	59,070	18,513	40,557
Achievement	57.9	48,790	20,498	28,292
Reduction	10.5	10,280	-1,985	12,265
Reduction Rate	15%	17%	-11%	30%

5. Cost-benefit Analysis

i) Benefit generated from the NRW reduction activities

NRW reduction volume is calculated as the differences between those when the activity was to be implemented (With-project) and when it was not to be implemented (Without-project). Volume of integral calculus of this difference is effect volume, and the thing which multiplied water unit price by effect volume becomes the benefit.

ii) Conversion of benefit and cost to “present values”

Benefit is generated and cost is incurred over the years. For an activity that takes time to generate benefit, a value of benefit at a time different from the present is different from that of the same benefit

at present. To compare benefit generated and cost incurred over the years, benefit and cost in each year were corrected to those in a reference year, “present values.”

$PV = A \times 1/(1+i)^n$,

where PV : Present value,

A : Benefit generated or cost incurred in the nth years after the implementation of an activity

i : Discount rate = 6 % (the average of the consumer price index, inflation rate and bank interest rate in Rwanda for the past 10 years)

A net present value (NPV) is calculated by subtracting gross cost from gross benefit. The NPV of this project is obtained by subtracting the NPV in the Without-project case from that in the With-project case. The formula to calculate NPV is as follows:

$NPV = \Sigma\ (Bt-Ct)/(1+i)^t$,

where Bt : Benefit in the t th year

Ct : Cost in the t th year

T : Numbers of years after the completion

I : Discount rate

iii) Relevance of Project Activities

Investment in project activities is considered relevant if the net benefit from the project is larger than its cost and the return of the investment is large, or if NPV > 0 and B/C > 1, where

- NPV : Net present value and
- B/C : Benefit-cost ratio.

iv) Comparison of Net Benefit from Project Implementation and Cost

The benefit is generated in the following two cases:

Case A: Increase in the water bill revenue resulting from the increase in the volume of revenue water due to the NRW reduction; and

Case B: Reduction in the water purification and supply cost (O&M cost) at a purification plant due to the water leakage reduction.

In practice, the benefit was calculated as the revenue from the sales of the surplus water generated by the leakage reduction to supplement the water demand in the service areas of the branches in Case A and as the reduction in the cost of water production at the Nzove Purification Plant, where the water

supplied to the service areas was produced, enabled by the leakage reduction in Case B. The comparison of the calculated net benefits in the two cases conducted in this report revealed that Case A was more practical and had a large effect than Case B.

v) Cost and Water Prices

- The initial cost (CAPEX for 1st year) included the costs for the activities for NRW reduction (leakage survey and repair, PRV installation, replacement of distribution and service pipes etc.) and for the preparation for the NRW reduction activities (hydraulic isolation of the area for the formation of DMA, installation of flow meters and chambers, etc.) in the pilot areas. The total costs of the project activities are shown in the Table 14 and Table15.
- The maintenance cost (OPEC from 2nd year)

  In the case of With-project：leakage survey, leakage repair

  (repair number：Kadobogo 3 places/month、Ruyenzi 23 places/month)

  In the case of Without-project：leakage repair

  (repair number: Kadobogo 12places/month、Ruyenzi 26 places/month)
- Period for the calculation: 10 years from the year activity implemented
- Values used in the calculation

  In the case of With-project:

  The actual distribution volume, billed volume and NRW rate up to March 2020 were used.

  In the case of Without-project:

  The monthly distribution volume was multiplied the monthly water supply rate of change in Kigali City (refer to Table 2) by the value of occurrence month of the effect. The same value of the volume of billed water as the case of With-project was used. The NRW rate was calculated by distribution volume and billed volume.
- Water price:

  Selling prices: 567 RWF/m3 in Kacyiru and 592 RWF/m3 in Nyarugenge (monthly averages in 2018)

  Purified water production cost: 319 RWF/m3 at the Nzove Purification plant (monthly averages in 2018)

The table below shows the total monthly volumes of the billed water in 2018 and the water bills per POC (RWF/POC) and those per the water consumption (RWF/m3) in Kacyiru and Nyarugenge Branches. While the water bills included tax, fee for meter rental (100 RWF) and regulator fee, the average of the water bills per m3 exclusive of the tax and the fees were used in the cost-benefit analysis.

Table 7 Monthly average water bill (2018)

Item	Unit	Kacyiru	Nyarugenge	All 20Branch
POC		18,413	18,127	192,349
Consumption	m3	338,058	339,915	2,403,970
Unit Consumption	m3/POC	18.4	18.8	12.5
Billing	RWF	191,590,224	201,278,615	1,232,017,358
Billing/POC	RWF/POC	10,405	11,104	6,405
Billing/m3	RWF/m3	567	592	512

The result of calculation is as shown below.

Calculation of benefit

Fig. 2.24 shows the benefit of the project implementation. While the baseline NRW rate was the same in both With- and Without- Project cases, the rate decreased significantly in the cases of With-Project with the implementation of NRW reduction activities. Therefore, there is a difference between the volume of distributed water in the case of Without-Project calculated from the volume of billed water and the actual volume of distributed water in the case of With-Project and the difference between the two shows the volume of the leakage reduction. The benefit is obtained by multiplying the volume of the leakage reduction by the cost of the water supply per volume.

Fig. 2.24. Diagram used for cost-benefit analysis of NRW reduction activities in Kadobogo

(3) Cost-benefit Analysis of Pilot Projects

After the completion of the activities in the pilot projects in Kadobogo and Ruyenzi, a cost-benefit analysis of the projects was conducted based on the NRW rates measured until January 2020.

Water consumption by customers is assumed to increase by the volume of the surplus water generated by NRW reduction activities. In other words, the surplus water was considered to generate the benefit of increasing the water charge income.

Project Effect of Kadobogo

A: Selling of Surplus Water

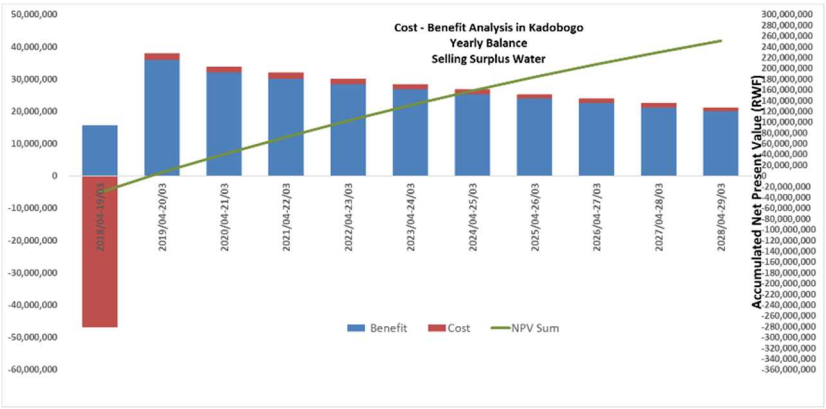
Table 8 Results of Cost-benefit Analysis in Kadobogo (Case A)

Cost (DMA Formation, PRV installation, Pipe replacement, Leakage repair)

Unit:RWF

	Year	Benefit			Cost			NPV (Benefit-Cost)	Effect of the Project (Accumulation)				Discount Rate %	6.0
		WP	WoP	Balance	WP	WoP	Balance		Benefit	Cost	NPV Sum	B/C	Conversion Factor	1/(1+i)^n
1	2018/04-19/03	15,826,812	0	15,826,812	50,675,787	3,754,944	-46,920,843	-31,094,031	15,826,812	-46,920,843	-31,094,031	0.3	0	1.000
2	2019/04-20/03	35,967,515	0	35,967,515	1,512,453	3,542,400	2,029,947	37,997,462	51,794,327	-44,890,896	6,903,431	1.2	1	0.943
3	2020/04-21/03	32,010,960	0	32,010,960	1,426,842	3,341,887	1,915,044	33,926,005	83,805,287	-42,975,851	40,829,436	2.0	2	0.890
4	2021/04-22/03	30,199,019	0	30,199,019	1,346,078	3,152,723	1,806,646	32,005,665	114,004,306	-41,169,206	72,835,100	2.8	3	0.840
5	2022/04-23/03	28,489,640	0	28,489,640	1,269,885	2,974,267	1,704,383	30,194,023	142,493,946	-39,464,823	103,029,123	3.6	4	0.792
6	2023/04-24/03	26,877,019	0	26,877,019	1,198,004	2,805,913	1,607,908	28,484,928	169,370,966	-37,856,914	131,514,051	4.5	5	0.747
7	2024/04-25/03	25,355,679	0	25,355,679	1,130,193	2,647,087	1,516,895	26,872,573	194,726,644	-36,340,020	158,386,624	5.4	6	0.705
8	2025/04-26/03	23,920,452	0	23,920,452	1,066,220	2,497,252	1,431,033	25,351,484	218,647,096	-34,908,987	183,738,108	6.3	7	0.665
9	2026/04-27/03	22,566,464	0	22,566,464	1,005,868	2,355,898	1,350,031	23,916,494	241,213,559	-33,558,956	207,654,603	7.2	8	0.627
10	2027/04-28/03	21,289,117	0	21,289,117	948,932	2,222,546	1,273,614	22,562,731	262,502,676	-32,285,342	230,217,334	8.1	9	0.592
11	2028/04-29/03	20,084,072	0	20,084,072	895,219	2,096,741	1,201,523	21,285,595	282,586,748	-31,083,820	251,502,928	9.1	10	0.558

0.28 NPV/Billing



Project Effect of Kadobogo

B: Reduction of Product Cost

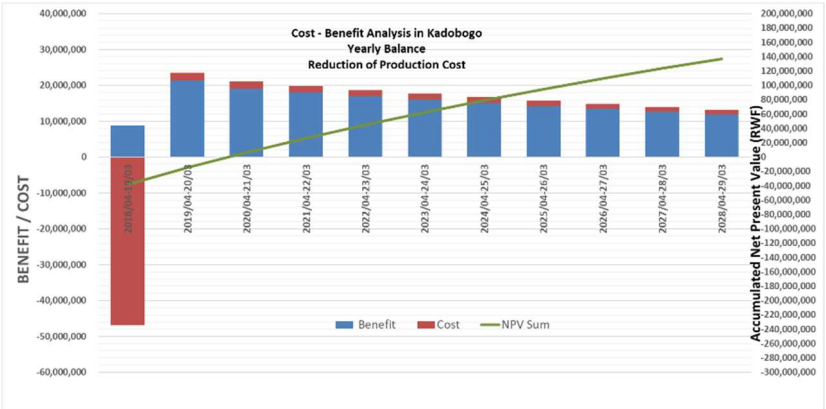
Table 9 Results of Cost-benefit Analysis in Kadobogo (Case B)

Cost (DMA Formation, PRV installation, Pipe replacement, Leakage repair)

Unit:RWF

	Year	Benefit			Cost			NPV (Benefit-Cost)	Effect of the Project (Accumulation)				Discount Rate %	6.0
		WP	WoP	WP	WP	WoP	Balance		Benefit	Cost	NPV Sum	B/C	Conversion Factor	1/(1+i)^n
1	2018/04-19/03	8,904,326	0	8,904,326	50,675,787	3,754,944	-46,920,843	-38,016,517	8,904,326	-46,920,843	-38,016,517	0.2	0	1.000
2	2019/04-20/03	21,449,833	0	21,449,833	1,512,453	3,542,400	2,029,947	23,479,780	30,354,160	-44,890,896	-14,536,736	0.7	1	0.943
3	2020/04-21/03	19,090,275	0	19,090,275	1,426,842	3,341,887	1,915,044	21,005,320	49,444,435	-42,975,851	6,468,583	1.2	2	0.890
4	2021/04-22/03	18,009,694	0	18,009,694	1,346,078	3,152,723	1,806,646	19,816,339	67,454,128	-41,169,206	26,284,923	1.6	3	0.840
5	2022/04-23/03	16,990,277	0	16,990,277	1,269,885	2,974,267	1,704,383	18,694,660	84,444,405	-39,464,823	44,979,582	2.1	4	0.792
6	2023/04-24/03	16,028,563	0	16,028,563	1,198,004	2,805,913	1,607,908	17,636,471	100,472,968	-37,856,914	62,616,054	2.7	5	0.747
7	2024/04-25/03	15,121,286	0	15,121,286	1,130,193	2,647,087	1,516,895	16,638,181	115,594,254	-36,340,020	79,254,235	3.2	6	0.705
8	2025/04-26/03	14,265,364	0	14,265,364	1,066,220	2,497,252	1,431,033	15,696,397	129,859,619	-34,908,987	94,950,631	3.7	7	0.665
9	2026/04-27/03	13,457,891	0	13,457,891	1,005,868	2,355,898	1,350,031	14,807,922	143,317,509	-33,558,956	109,758,553	4.3	8	0.627
10	2027/04-28/03	12,696,123	0	12,696,123	948,932	2,222,546	1,273,614	13,969,737	156,013,633	-32,285,342	123,728,290	4.8	9	0.592
11	2028/04-29/03	11,977,475	0	11,977,475	895,219	2,096,741	1,201,523	13,178,997	167,991,107	-31,083,820	136,907,288	5.4	10	0.558

0.17 NPV/Billing



Project Effect of Ruyenzi

A: Selling of Surplus Water

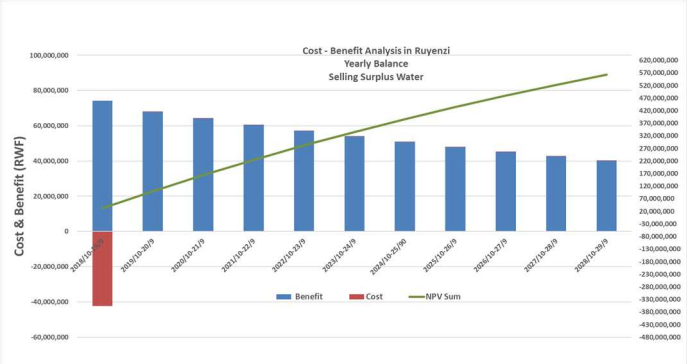
Table 10 Results of Cost-benefit Analysis in Ruyenzi (Case A)

Cost (DMA Formation, PRV installation, Pipe replacement, Leakage repair)

Unit:RWF

	Year	Benefit			Cost			NPV (Benefit-Cost)	Effect of the Project (Accumulation)				Discount Rate %	6.0
		WP	WoP	Balance	WP	WoP	Balance		Benefit	Cost	NPV Sum	B/C	Conversion Factor	1/(1+i)^n
1	2018/10-19/9	74,299,139	0	74,299,139	50,356,400	7,937,280	-42,419,120	31,880,019	74,299,139	-42,419,120	31,880,019	1.8	0	1.000
2	2019/10-20/9	67,984,224	0	67,984,224	7,416,453	7,488,000	71,547	68,055,771	142,283,363	-42,347,573	99,935,790	3.4	1	0.943
3	2020/10-21/9	64,136,060	0	64,136,060	6,996,654	7,064,151	67,497	64,203,558	206,419,424	-42,280,076	164,139,348	4.9	2	0.890
4	2021/10-22/9	60,505,717	0	60,505,717	6,600,617	6,664,293	63,677	60,569,394	266,925,141	-42,216,399	224,708,742	6.3	3	0.840
5	2022/10-23/9	57,080,865	0	57,080,865	6,226,997	6,287,069	60,072	57,140,938	324,006,006	-42,156,326	281,849,680	7.7	4	0.792
6	2023/10-24/9	53,849,873	0	53,849,873	5,874,525	5,931,197	56,672	53,906,545	377,855,879	-42,099,654	335,756,225	9.0	5	0.747
7	2024/10-25/90	50,801,767	0	50,801,767	5,542,005	5,595,469	53,464	50,855,231	428,657,646	-42,046,190	386,611,456	10.2	6	0.705
8	2025/10-26/9	47,926,195	0	47,926,195	5,228,307	5,278,745	50,438	47,976,633	476,583,842	-41,995,752	434,588,089	11.3	7	0.665
9	2026/10-27/9	45,213,392	0	45,213,392	4,932,365	4,979,948	47,583	45,260,975	521,797,233	-41,948,169	479,849,064	12.4	8	0.627
10	2027/10-28/9	42,654,143	0	42,654,143	4,653,174	4,698,064	44,890	42,699,033	564,451,377	-41,903,280	522,548,097	13.5	9	0.592
11	2028/10-29/9	40,239,758	0	40,239,758	4,389,787	4,432,136	42,349	40,282,106	604,691,134	-41,860,931	562,830,203	14.4	10	0.558

0.36 NPV/Billing



B: Reduction of Production Cost

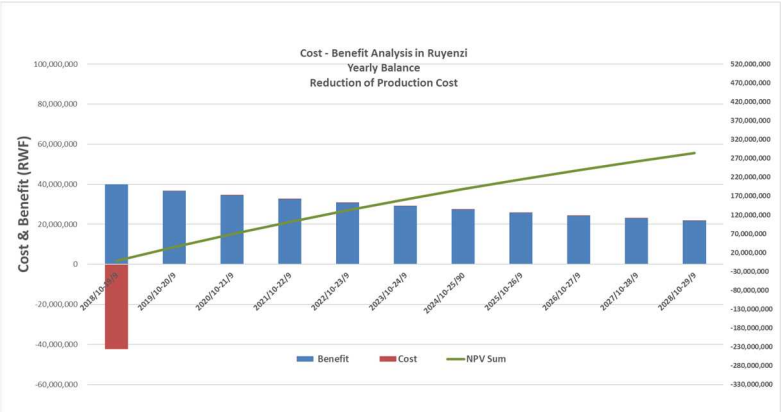
Table 11 Results of Cost-benefit Analysis in Ruyenzi (Case B)

Cost (DMA Formation, PRV installation, Pipe replacement, Leakage repair)

Unit:RWF

	Year	Benefit			Cost			NPV (Benefit-Cost)	Effect of the Project (Accumulation)				Discount Rate %	6.0
		WP	WoP	WP	WP	WoP	Balance		Benefit	Cost	NPV Sum	B/C	Conversion Factor	1/(1+i)^n
1	2018/10-19/9	40,036,192	0	40,036,192	50,356,400	7,937,280	-42,419,120	-2,382,928	40,036,192	-42,419,120	-2,382,928	0.9	0	1.000
2	2019/10-20/9	36,633,391	0	36,633,391	7,416,453	7,488,000	71,547	36,704,938	76,669,583	-42,347,573	34,322,010	1.8	1	0.943
3	2020/10-21/9	34,559,803	0	34,559,803	6,996,654	7,064,151	67,497	34,627,300	111,229,385	-42,280,076	68,949,310	2.6	2	0.890
4	2021/10-22/9	32,603,588	0	32,603,588	6,600,617	6,664,293	63,677	32,667,264	143,832,973	-42,216,399	101,616,574	3.4	3	0.840
5	2022/10-23/9	30,758,101	0	30,758,101	6,226,997	6,287,069	60,072	30,818,174	174,591,074	-42,156,326	132,434,748	4.1	4	0.792
6	2023/10-24/9	29,017,077	0	29,017,077	5,874,525	5,931,197	56,672	29,073,749	203,608,151	-42,099,654	161,508,497	4.8	5	0.747
7	2024/10-25/90	27,374,601	0	27,374,601	5,542,005	5,595,469	53,464	27,428,065	230,982,752	-42,046,190	188,936,562	5.5	6	0.705
8	2025/10-26/9	25,825,095	0	25,825,095	5,228,307	5,278,745	50,438	25,875,533	256,807,847	-41,995,752	214,812,095	6.1	7	0.665
9	2026/10-27/9	24,363,297	0	24,363,297	4,932,365	4,979,948	47,583	24,410,880	281,171,144	-41,948,169	239,222,975	6.7	8	0.627
10	2027/10-28/9	22,984,243	0	22,984,243	4,653,174	4,698,064	44,890	23,029,132	304,155,387	-41,903,280	262,252,107	7.3	9	0.592
11	2028/10-29/9	21,683,248	0	21,683,248	4,389,787	4,432,136	42,349	21,725,596	325,838,635	-41,860,931	283,977,704	7.8	10	0.558

0.19 NPV/Billing



The results of the analysis are as follows:

- In Kadobogo and Ruyenzi, the calculation of the NPV and B/C values clearly shows the effect of the NRW reduction activities (NPV>0 and B/C>1) in each area.
- Benefit in Case A (Increase in the water bill revenue) is higher than that in case B (Reduction of O&M cost). Followings are mentioned in the case A.
- In Kadobogo, net benefit is generated from the 2nd year of implementation of the NRW reduction activities because the effect of the activities exceeds the implementation cost (CAPEX and OPEX). (B/C, the ratio of accumulated benefit to accumulated cost, is more than 1.0.) In Ruyenzi, B/C exceed 1.0 in the 1st year.
- The B/C values in the two areas in the fifth year will be high (3.6 in Kadobogo and 7.7 in Ruyenzi). At the same time, the cumulative net benefits of about 100 % and about 190 % of the annual billed water charges will be generated in Kadobogo and Ruyenzi, respectively, in the fifth year.
- The average annual net benefits in the ten years will be approx. 28 % and 36 % of the annual billed water charges in Kadobogo and Ruyenzi, respectively.
- The NRW ratio of 25 % has been achieved in Kadobogo and NRW reduction volume was 13%. In Ruyenzi, the achieved NRW ratio was 58 % and NRW reduction volume was 11%. However, the cost-benefit analysis has revealed that the investment in the NRW reduction activities has produced a sufficient effect on NRW reduction by the reduction of 11% even where the NRW rate is high such as 58% in Ruyenzi.

In conclusion, the investment in NRW reduction activities had sufficient effect when the activities reduced the NRW rate to a certain degree (by approx. 10 %) even if the rate was very high like in Ruyenzi (68 %). Therefore, it is important to actively promote cost-effective activities, such as the reduction of high water pressure (installation of PRVs), surveys and repair of water leakage (underground water leakage, in particular), and replacement of distribution and service pipes.

Kadobogo Pilot Project

Table 12 Cost-benefit Calculation of Kadobogo

Without Project (WoP)

	Year	Distribution		Billing		NRW				
	Month	Volume ①	Production Cost①	Volume	Billing Price	Volume	Rate			
		m3	RWF	m3	RWF		%			
			319		567					
	2017/6	19,054	6,078,226	11,345	6,432,615	7,709	40.5%	Baseline		
	2017/7	20,389	6,504,091	13,412	7,604,604	6,977	34.2%	Baseline 37.3%		
	2017/8	21,279	6,788,001	17,374	9,851,058	3,905	18.4%			
	2017/9	19,466	6,209,654	14,246	8,077,482	5,220	26.8%			
	2017/10	16,350	5,215,650	13,397	7,596,099	2,953	18.1%			
	2017/11	17,366	5,539,754	12,959	7,347,753	4,407	25.4%			
	2017/12	18,609	5,936,271	13,908	7,885,836	4,701	25.3%			
	2018/1	22,694	7,239,386	14,765	8,371,755	7,929	34.9%			
	2018/2	21,677	6,914,963	13,351	7,570,017	8,326	38.4%			
	2018/3	19,439	6,201,041	11,579	6,565,293	7,860	40.4%			
1	2018/4	22,328	7,122,632	13,499	7,653,933	8,829	39.5%	Starting Activities		
2	2018/5	21,373	6,817,987	12,822	7,270,074	8,551	40.0%			
3	2018/6	22,445	7,159,955	15,340	8,697,780	7,105	31.7%			
4	2018/7	22,862	7,292,978	15,175	8,604,225	7,687	33.6%			
5	2018/8	23,138	7,381,022	16,541	9,378,747	6,597	28.5%			1.00
6	2018/9	23,294	7,430,712	16,595	9,409,365	6,699	28.8%			1.01
7	2018/10	23,384	7,459,505	15,496	8,786,232	7,888	33.7%			1.01
8	2018/11	22,656	7,227,352	14,792	8,387,064	7,864	34.7%			0.98
9	2018/12	22,924	7,312,853	14,000	7,938,000	8,924	38.9%			0.99
10	2019/1	22,807	7,275,398	16,816	9,534,672	5,991	26.3%			0.99
11	2019/2	21,115	6,735,563	14,367	8,146,089	6,748	32.0%			0.91
12	2019/3	22,323	7,121,153	13,834	7,843,878	8,489	38.0%	101,650,059.00	Billing	0.96
1	2019/4	22,270	7,104,174	12,939	7,336,413	9,331	41.9%			0.96
2	2019/5	23,383	7,459,157	12,986	7,363,062	10,397	44.5%			1.01
3	2019/6	23,157	7,386,965	13,492	7,649,964	9,665	41.7%			1.00
4	2019/7	25,623	8,173,666	13,880	7,869,960	11,743	45.8%			1.11
5	2019/8	25,576	8,158,718	14,221	8,063,307	11,355	44.4%			1.11
6	2019/9	22,909	7,308,109	14,877	8,435,259	8,032	35.1%			0.99
7	2019/10	22,558	7,196,143	13,736	7,788,312	8,822	39.1%			0.97
8	2019/11	23,560	7,515,595	11,265	6,387,255	12,295	52.2%			1.02
9	2019/12	22,923	7,312,497	13,342	7,564,914	9,581	41.8%			0.99
10	2020/1	24,469	7,805,721	14,100	7,994,700	10,369	42.4%			1.06
11	2020/2	22,354	7,130,901	13,143	7,452,081	9,211	41.2%			0.97
12	2020/3	24,117	7,693,410	14,388	8,157,996	9,729	40.3%			1.04

Note: NRW Baseline 37.3%

With Project (WP)

	Year/ Month	Distribution		Billing		NRW		Project Effect				
		Volume ②	Production Cost②	Volume	Billing Price	Volume	Rate	Volume ③	Selling of Surplus Water	Reduction of Production Cost		
								①−②	Volume③×567	Volume③×319		
		m3	RWF	m3	RWF		%	m3	RWF	RWF		
			319		567				567	319		
	2017/6	19,054	6,078,226	11,345	6,432,615	7,709	40.5%	0	0	0		
	2017/7	20,389	6,504,091	13,412	7,604,604	6,977	34.2%	0	0	0		
	2017/8	21,279	6,788,001	17,374	9,851,058	3,905	18.4%	0	0	0		
	2017/9	19,466	6,209,654	14,246	8,077,482	5,220	26.8%	0	0	0		
	2017/10	16,350	5,215,650	13,397	7,596,099	2,953	18.1%	0	0	0		
	2017/11	17,366	5,539,754	12,959	7,347,753	4,407	25.4%	0	0	0		
	2017/12	18,609	5,936,271	13,908	7,885,836	4,701	25.3%	0	0	0		
	2018/1	22,694	7,239,386	14,765	8,371,755	7,929	34.9%	0	0	0		
	2018/2	21,677	6,914,963	13,351	7,570,017	8,326	38.4%	0	0	0		
	2018/3	19,439	6,201,041	11,579	6,565,293	7,860	40.4%	0	0	0		
1	2018/4	22,328	7,122,632	13,499	7,653,933	8,829	39.5%	0	0	0		
2	2018/5	21,373	6,817,987	12,822	7,270,074	8,551	40.0%	0	0	0		
3	2018/6	22,445	7,159,955	15,340	8,697,780	7,105	31.7%	0	0	0		
4	2018/7	22,862	7,292,978	15,175	8,604,225	7,687	33.6%	0	0	0		
5	2018/8	23,138	7,381,022	16,541	9,378,747	6,597	28.5%	0	0	0		
6	2018/9	20,913	6,671,247	16,595	9,409,365	4,318	20.6%	2,381	1,349,895	759,465		
7	2018/10	21,358	6,813,202	15,496	8,786,232	5,862	27.4%	2,026	1,148,758	646,303		
8	2018/11	18,991	6,058,129	14,792	8,387,064	4,199	22.1%	3,665	2,078,212	1,169,223		
9	2018/12	18,000	5,742,000	14,000	7,938,000	4,000	22.2%	4,924	2,792,081	1,570,853		
10	2019/1	18,800	5,997,200	16,816	9,534,672	1,984	10.6%	4,007	2,271,908	1,278,198		
11	2019/2	16,408	5,234,152	14,367	8,146,089	2,041	12.4%	4,707	2,668,652	1,501,411		
12	2019/3	16,120	5,142,280	13,834	7,843,878	2,286	14.2%	6,203	3,517,307	1,978,873	15,826,812	8,904,326
1	2019/4	16,059	5,122,821	12,939	7,336,413	3,120	19.4%	6,211	3,521,715	1,981,353		
2	2019/5	15,712	5,012,128	12,986	7,363,062	2,726	17.3%	7,671	4,349,422	2,447,029		
3	2019/6	19,227	6,133,413	13,492	7,649,964	5,735	29.8%	3,930	2,228,100	1,253,552		
4	2019/7	19,404	6,189,876	13,880	7,869,960	5,524	28.5%	6,219	3,526,047	1,983,790		
5	2019/8	19,885	6,343,315	14,221	8,063,307	5,664	28.5%	5,691	3,226,751	1,815,403		
6	2019/9	18,956	6,046,964	14,877	8,435,259	4,079	21.5%	3,953	2,241,596	1,261,145		
7	2019/10	18,012	5,745,828	13,736	7,788,312	4,276	23.7%	4,546	2,577,832	1,450,315		
8	2019/11	17,633	5,624,927	11,265	6,387,255	6,368	36.1%	5,927	3,360,526	1,890,668		
9	2019/12	17,843	5,691,917	13,342	7,564,914	4,501	25.2%	5,080	2,880,467	1,620,580		
10	2020/1	18,456	5,887,464	14,100	7,994,700	4,356	23.6%	6,013	3,409,566	1,918,257		
11	2020/2	17,911	5,713,609	13,143	7,452,081	4,768	26.6%	4,443	2,519,136	1,417,292		
12	2020/3	16,561	5,282,959	14,388	8,157,996	2,173	13.1%	7,556	4,284,406	2,410,451	38,125,566	21,449,833
	Total							95,154	53,952,378	30,354,160		

Note : Cost 319 RWF: Monthly average production cost of Nzove Treatment Plant

Price 567 RWF: Monthly average water billing of Kacyiru Branch

2018/04-19/03	1st Year	**15,826,812**	**8,904,326**
2019/04-20/03	2nd Year	**38,125,566**	**21,449,833**

Cost Benefit Analysis
Ruyenzi Pilot Project

Table 13 Cost-benefit Calculation of Ruyenzi

Without Project (WoP)

	Year	Distribution		Billing		NRW				
	Month	Volume ①	Production Cost①	Volume	Billing Price	Volume	Rate			
		m3	RWF	m3	RWF		%			
			319		592					
	2018/3	54,812	17,485,028	19,486	11,535,712	35,326	64.4%	Baseline		
	2018/4	63,327	20,201,313	17,540	10,383,680	45,787	72.3%	Baseline 68.4%		
	2018/5	50,826	16,213,494	14,753	8,733,776	36,073	71.0%			
	2018/6	37,437	11,942,403	17,520	10,371,840	19,917	53.2%			
	2018/7	40,226	12,832,094	20,910	12,378,720	19,316	48.0%			
	2018/8	47,153	15,041,807	23,820	14,101,440	23,333	49.5%			
	2018/9	47,161	15,044,359	20,543	12,161,456	26,618	56.4%			
1	2018/10	51,242	16,346,198	20,588	12,188,096	30,654	59.8%	Starting Activities		1.00
2	2018/11	57,231	18,256,738	16,427	9,724,784	40,804	71.3%			0.97
3	2018/12	57,908	18,472,720	20,304	12,019,968	37,604	64.9%			0.98
4	2019/1	57,612	18,378,107	23,271	13,776,432	34,341	59.6%			0.98
5	2019/2	53,337	17,014,449	21,055	12,464,560	32,282	60.5%			0.90
6	2019/3	56,390	17,988,473	18,094	10,711,648	38,296	67.9%			0.95
7	2019/4	56,256	17,945,582	20,662	12,231,904	35,594	63.3%			0.95
8	2019/5	59,067	18,842,292	19,722	11,675,424	39,345	66.6%			1.00
9	2019/6	58,495	18,659,930	18,264	10,812,288	40,231	68.8%			0.99
10	2019/7	64,725	20,647,186	24,518	14,514,656	40,207	62.1%			1.10
11	2019/8	64,606	20,609,427	24,397	14,443,024	40,209	62.2%			1.09
12	2019/9	57,871	18,460,736	22,571	13,362,032	35,300	61.0%	147,924,816	Billing	0.98
1	2019/10	56,984	18,177,902	20,030	11,857,760	36,954	64.8%			0.96
2	2019/11	59,514	18,984,857	19,306	11,429,152	40,208	67.6%			1.01
3	2019/12	57,905	18,471,820	19,392	11,480,064	38,513	66.5%			0.98
4	2020/1	61,811	19,717,733	23,326	13,808,992	38,485	62.3%			1.05
5	2020/2	56,467	18,013,097	20,651	12,225,392	35,816	63.4%			0.96
6	2020/3	60,922	19,434,029	20,283	12,007,536	40,639	66.7%			1.03

Note: NRW Baseline 68.4% 507,433

With Project (WP)

	Year/ Month	Distribution		Billing		NRW		Project Effect		
		Volume ②	Production Cost②	Volume	Billing Price	Volume	Rate	Volume ③	Selling of Surplus Water	Reduction of Production Cost
								①-②	Volume③x592	Volume③x319
		m3	RWF	m3	RWF		%	m3	RWF	RWF
			319		592				592	319
	2018/3	54,812	17,485,028	19,486	11,535,712	35,326	64.4%	0	0	0
	2018/4	63,327	20,201,313	17,540	10,383,680	45,787	72.3%	0	0	0
	2018/5	50,826	16,213,494	14,753	8,733,776	36,073	71.0%	0	0	0
	2018/6	37,437	11,942,403	17,520	10,371,840	19,917	53.2%	0	0	0
	2018/7	40,226	12,832,094	20,910	12,378,720	19,316	48.0%	0	0	0
	2018/8	47,153	15,041,807	23,820	14,101,440	23,333	49.5%	0	0	0
	2018/9	47,161	15,044,359	20,543	12,161,456	26,618	56.4%	0	0	0
1	2018/10	51,242	16,346,198	20,588	12,188,096	30,654	59.8%	0	0	0
2	2018/11	48,539	15,483,941	16,427	9,724,784	32,112	66.2%	8,692	5,145,756	2,772,797
3	2018/12	47,923	15,287,437	20,304	12,019,968	27,619	57.6%	9,985	5,911,246	3,185,283
4	2019/1	49,026	15,639,294	23,271	13,776,432	25,755	52.5%	8,586	5,082,687	2,738,813
5	2019/2	47,189	15,053,291	21,055	12,464,560	26,134	55.4%	6,148	3,639,516	1,961,158
6	2019/3	38,875	12,401,125	18,094	10,711,648	20,781	53.5%	17,515	10,368,997	5,587,348
7	2019/4	49,156	15,680,764	20,662	12,231,904	28,494	58.0%	7,100	4,203,048	2,264,818
8	2019/5	43,285	13,807,915	19,722	11,675,424	23,563	54.4%	15,782	9,342,794	5,034,377
9	2019/6	42,917	13,690,523	18,264	10,812,288	24,653	57.4%	15,578	9,222,222	4,969,407
10	2019/7	48,084	15,338,796	24,518	14,514,656	23,566	49.0%	16,641	9,851,306	5,308,390
11	2019/8	51,863	16,544,297	24,397	14,443,024	27,466	53.0%	12,743	7,544,065	4,065,130
12	2019/9	51,135	16,312,065	22,571	13,362,032	28,564	55.9%	6,736	3,987,501	2,148,671
1	2019/10	47,168	15,046,592	20,030	11,857,760	27,138	57.5%	9,816	5,811,083	3,131,310
2	2019/11	46,755	14,914,845	19,306	11,429,152	27,449	58.7%	12,759	7,553,126	4,070,012
3	2019/12	50,999	16,268,681	19,392	11,480,064	31,607	62.0%	6,906	4,088,584	2,203,139
4	2020/1	48,312	15,411,528	23,326	13,808,992	24,986	51.7%	13,499	7,991,453	4,306,205
5	2020/2	50,589	16,137,891	20,651	12,225,392	29,938	59.2%	5,878	3,480,005	1,875,206
6	2020/3	48,916	15,604,204	20,283	12,007,536	28,633	58.5%	12,006	7,107,387	3,829,825

Note : Cost 319 RWF: Monthly average production cost of Nzove Treatment Plant
Price 592 RWF: Monthly average water billing of New Nyarugenge Branch

1st Year	2018/10-19/9	**74,299,139**	**40,036,192**
2nd Yesr	2019/10-20/3	**36,031,639**	**19,415,697**

Table 14 Cost Estimation of the Reduction Activities in Kadobogo

Cost of NRW Reduction Activity for KADOBOGO Pilot Area Case 2 RWF

		WASAC activity				Project Activity				WASAC COST			TOTAL WASAC	PROJECT COST			TOTAL JICA	TOTAL COST
		Emergency Action				Premeditated Action												
		Accident, Request of Customer				Planning based on the analysis of monitoring												
Activity	Day	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	PM1	PM2	PM3		PM1	PM2	PM3		
		PM1	PM2	PM3	Total	PM1	PM2	PM3	Total									
1. Preparation Work														DN80	DN80	DN50		
1.1 DMA Creation																		
Preparation of the map (GIS, Google map)						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Pipe network map						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
POC list and location map						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Design of DMA and Sub-zone		-	-	-	-	1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Pressure survey for Isolation		-	-	-	-	1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Pipe replacement (Area adjustment)						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Finalization of zone area		-	-	-	-	1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Finalization of POC list in DMA and Update of the list (New Connection)						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Survey of the existing facilities in DMA (Valve, PRV, Pipe, etc.)													0	10,000	10,000	10,000	30,000	**30,000**
Isolation valve installation								1					0		161,720		161,720	**161,720**
Valve installation for step test								1					0		1,637,817		1,637,817	**1,637,817**
1.2 Installation of Inlet and Outlet Facility																		
Inlet Facility (Chamber, Equipment)		-	-	-	-	1	1	1	3				0	7,737,950	8,223,700	7,714,515	23,676,165	**23,676,165**
Outlet Facility													0				0	**0**
Total													0				25,745,702	**25,745,702**
2. Activity for Commercial Loss reduction																		
2.1 Customer data analysis (Billing)																		
Analysis the Data inside the pilot area													0	30,600	2,100	27,300	60,000	**0**
2.2 Customer Meter Survey/ POC Survey																		
Survey by visit all customers													0	652,800	44,800	582,400	1,280,000	**0**
2.3 Customer Questionnaire Survey																		
Questionnaire													0	150,000	150,000	150,000	450,000	**0**
Analysis													0	70,000	30,000	60,000	160,000	**0**
2.4 On-site Meter Test																		
Identified										0	0	0	0	652,800	44,800	582,400	1,280,000	**0**
Test meter										0	0	0	0	2,312,315	157,984	2,089,701	4,560,000	**0**
2.5 Meter Replacement																	0	
Meter replaced (Site work)										0	0	0	0	2,904,636	187,947	2,067,417	5,160,000	**0**
Customer meter procurement	47,200								323		0		0		15,245,600		15,245,600	**0**
2.6 Inspection of illegal connection/use																		
Inspection work on site visit										0	0	0	0	408,000	28,000	364,000	800,000	**800,000**
Total													0				28,995,600	**800,000**
3. Activity for Physical Loss reduction		PM1	PM2	PM3	Total	PM1	PM2	PM3	Total									
3.1 Leakage Survey and Repair																		
1) Analysis of Leakage repair record													0	190,000	190,000	190,000	570,000	**570,000**
2) Qmnf measurement & Step Test	210,000	-	-	-	-		20		20				0		4,200,000		4,200,000	**4,200,000**
3) Modified Step Test & Leak detection	23,000	-	-	-	-	11	20	18	49				0	253,000	460,000	414,000	1,127,000	**1,127,000**
4) Leakage Repair (Include Preliminary work before repairing)																		
3000+22440	2017/6					-	-	-	-	0	0	0	0				0	**0**
	2017/7					-	-	-	-	0	0	0	0				0	**0**
	2017/8	1	1	4	6	-	-	-	-	25,440	25,440	101,760	152,640				0	**152,640**
	2017/9	4	4	5	13	-	-	-	-	101,760	101,760	127,200	330,720				0	**330,720**
	2017/10	10	1	3	14	-	-	-	-	254,400	25,440	76,320	356,160				0	**356,160**
	2017/11	13	4	3	20	-	-	-	-	330,720	101,760	76,320	508,800				0	**508,800**
	2017/12	6	2	1	9	-	-	-	-	152,640	50,880	25,440	228,960				0	**228,960**
	2018/1	5	3	4	12	-	-	-	-	127,200	76,320	101,760	305,280				0	**305,280**
	2018/2	6	1	0	7	-	-	-	-	152,640	25,440	0	178,080				0	**178,080**
	2018/3	3	1	3	7	-	-	4	4	76,320	25,440	76,320	178,080			101,760	101,760	**279,840**
	2018/4	4	4	3	11	1	1	4	6	101,760	101,760	76,320	279,840	25,440	25,440	101,760	152,640	**432,480**
	2018/5	2	1	2	5	-	-	-	-	50,880	25,440	50,880	127,200				0	**127,200**
	2018/6	2	1	2	5	-	1	-	1	50,880	25,440	50,880	127,200		25,440		25,440	**152,640**
	2018/7	2	0	3	5	-	-	-	-	50,880	0	76,320	127,200				0	**127,200**
	2018/8	7	0	0	7	9	2		11	178,080	0	0	178,080	228,960	50,880		279,840	**457,920**
	2018/9	5	0	1	6	-	-	-	-	127,200	0	25,440	152,640				0	**152,640**
	2018/10	7	0	0	7	-	-	-	-	178,080	0	0	178,080				0	**178,080**
	2018/11	6	0	0	6	-	-	-	-	152,640	0	0	152,640				0	**152,640**
	2018/12	5	0	0	5	-	-	-	-	127,200	0	0	127,200				0	**127,200**
	2019/1	4	0	1	5	-	-	-	-	101,760	0	25,440	127,200				0	**127,200**
	2019/2	3	0	1	4	-	-	-	-	76,320	0	25,440	101,760				0	**101,760**
	2019/3	3	0	1	4	-	-	-	-	76,320	0	25,440	101,760				0	**101,760**
Sub Total																		**10,476,200**
3.2 Pressure Control		-	-	-	-													
1) Pressure survey													0				0	**0**
2) Planning of PRV installation point								1	1				0	0	268,999	268,000	536,999	**536,999**
3) PRV														650,000	650,000	250,000	1,550,000	**1,550,000**
4) PRV Installation								1	1				0	2,000,000	348,852	1,944,767	4,293,619	**4,293,619**
Sub Total																		**6,380,618**
Total													4,019,520				12,837,298	**16,856,818**
4. Pipe Replacement						2019/2/28												
PM 1		PPR															0	**0**
Procurement of materials						1			1				0	4,010,100			4,010,100	**4,010,100**
Excavation & Backfilling						1			1				0	1,100,000			1,100,000	**1,100,000**
Installation						1			1				0	1,600,000			1,600,000	**1,600,000**
PM 2		PVC, PN50, L200m				2018/6/28							0				0	**0**
Pipe, Installation							1		1				0		473,167		473,167	**473,167**
Man powers							1		1				0		90,000		90,000	**90,000**
Total													0				7,273,267	**7,273,267**
5. Monitoring/Evaluation													0				0	**0**
NRW Rate Calculation		-	-	-	-								0	0	0	0	0	**0**
Total													0				0	**0**
Grand Total													**4,019,520**				**74,851,867**	**50,675,787**
																	Without Meter Work	**50,675,787**

Table 15 Cost Estimation of the Reduction Activities in Ruyenzi

Cost of NRW Reduction Activity for Ruyenzi Pilot Area Case 2 RWF

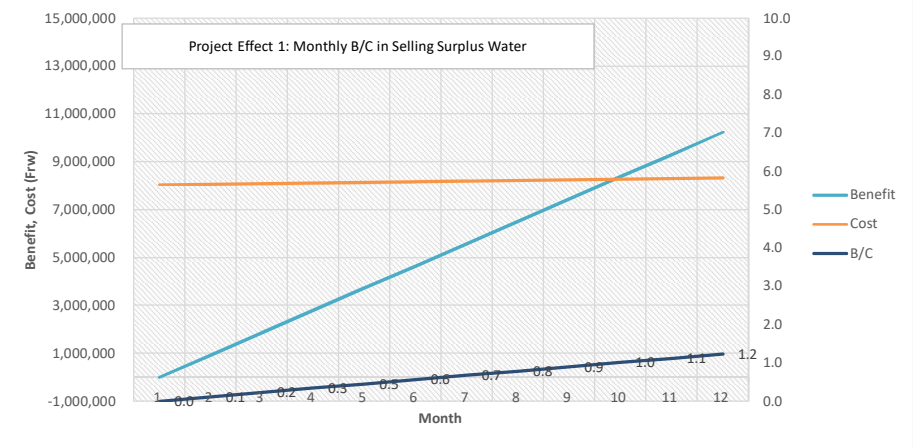
		WASAC activity				Project Activity				WASAC COST			TOTAL WASAC	PROJECT COST			TOTAL JICA	TOTAL COST
		Emergency Action				Premeditated Action												
		Accident, Request of Customer				Planning based on the analysis of monitoring												
Activity	Day	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	RY1	RY2	RY3		RY1	RY2	RY3		
		RY1	RY2	RY3	Total	RY1	RY2	RY3	Total									
1. Preparation Work																		
1.1 DMA Creation																		
Preparation of the map (GIS, Google map)						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Pipe network map						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
POC list and location map						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Design of DMA and Sub-zone		-	-	-	-	1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Pressure survey for Isolation		-	-	-	-	1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Pipe replacement (Area adjustment)						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Finalization of zone area		-	-	-	-	1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Finalization of POC list in DMA and Update of the list (New Connection)						1	1	1	3				0	10,000	10,000	10,000	30,000	**30,000**
Survey of the existing facilities in DMA (Valve, PRV, Pipe, etc.)													0	10,000	10,000	10,000	30,000	**30,000**
Isolation valve installation								1					0		1,500,000		1,500,000	**1,500,000**
Valve installation for step test								1					0		1,140,000		1,140,000	**1,140,000**
1.2 Installation of Inlet and Outlet Facility																		
Inlet Facility (Chamber, Equipment)		-	-	-	-			1	1				0			8,837,000	8,837,000	**8,837,000**
Outlet Facility													0				0	**0**
Total													0				11,747,000	**11,747,000**
2. Activity for Commercial Loss reduction																		
2.1 Customer data analysis (Billing)																		
Analysis the Data inside the pilot area													0					
2.2 Customer Meter Survey/ POC Survey																		
Survey by visit all customers	3,250								1705				0				5,541,250	**0**
2.3 Customer Questionnaire Survey																		
Questionnaire	3,250								222				0				721,500	**0**
													0					
2.4 On-site Meter Test																		
Site Test	6,500								413				0				2,684,500	**0**
2.5 Meter Replacement																		
Meter replacement	47,200								139				0				6,560,800	**0**
2.6 Inspection of illegal connection/use																		
Inspection work on site visit													0				800,000	**800,000**
Total													0				16,308,050	**800,000**
3. Activity for Physical Loss reduction		**RY1**	**RY2**	**RY3**	**Total**	**RY1**	**RY2**	**RY3**	**Total**									
3.1 Leakage Survey and Repair																		
1) Analysis of Leakage repair record													0		570,000		570,000	**570,000**
2) Qmnf measurement & Step Test		-	-	-	-		12		12				0		2,520,000		2,520,000	**2,520,000**
4) Leakage Repair (Include Preliminary work before repairing)																		
	2018/3	33	1	6	40	-	-	-	0	839,520	25,440	152,640	1,017,600	0	0	0	0	**1,017,600**
	2018/4	37	3	2	42	-	-	-	0	941,280	76,320	50,880	1,068,480	0	0	0	0	**1,068,480**
	2018/5	13	2	0	15	-	-	-	0	330,720	50,880	0	381,600	0	0	0	0	**381,600**
	2018/6	16	2	3	21	-	-	-	0	407,040	50,880	76,320	534,240	0	0	0	0	**534,240**
	2018/7	17	4	1	22	-	-	-	0	432,480	101,760	25,440	559,680	0	0	0	0	**559,680**
	2018/8	16	3	1	20	-	-	-	0	407,040	76,320	25,440	508,800	0	0	0	0	**508,800**
	2018/9	18	2	4	24	-	-	-	0	457,920	50,880	101,760	610,560	0	0	0	0	**610,560**
	2018/10	3	1	1	5	-	-	-	0	76,320	25,440	25,440	127,200	0	0	0	0	**127,200**
1	2018/11	18	3	9	30	-	-	-	0	457,920	76,320	228,960	763,200	0	0	0	0	**763,200**
2	2018/12	21	3	9	33	-	-	-	0	534,240	76,320	228,960	839,520	0	0	0	0	**839,520**
3	2019/1	15	2	1	18	-	-	-	0	381,600	50,880	25,440	457,920	0	0	0	0	**457,920**
4	2019/2	18	5	4	27	-	-	-	0	457,920	127,200	101,760	686,880	0	0	0	0	**686,880**
5	2019/3	0	1	2	3	13	3	-	16	0	25,440	50,880	76,320	330,720	76,320	0	407,040	**483,360**
6	2019/4	18	2	6	26	-	-	-	0	457,920	50,880	152,640	661,440	0	0	0	0	**661,440**
7	2019/5	18	5	6	29	-	-	-	0	457,920	127,200	152,640	737,760	0	0	0	0	**737,760**
8	2019/6	10	0	0	10	-	-	-	0	254,400	0	0	30,000	0	0	0	0	**30,000**
9	2019/7	13	2	3	18	2	-	-	2	330,720	50,880	76,320	457,920	50,880	0	0	50,880	**508,800**
10	2019/8	16	1	1	18	12	-	-	12	407,040	25,440	25,440	457,920	305,280	0	0	305,280	**763,200**
11	2019/9	17	1	1	19	-	-	-	0	432,480	25,440	25,440	483,360	0	0	0	0	**483,360**
12	2019/10					-	-	-	0	0	0	0	0	0	0	0	0	**0**
1	2019/11	15	1	5	21	-	-	-	0	381,600	25,440	127,200	534,240	0	0	0	0	**534,240**
2	2019/12	11	5	8	24	-	-	-	0	279,840	127,200	203,520	610,560	0	0	0	0	**610,560**
3	2020/1				0	-	-	-	0	0	0	0	0	0	0	0	0	**0**
4	2020/2				0	-	-	-	0	0	0	0	0	0	0	0	0	**0**
Sub-Total													**11,605,200**				**3,853,200**	**15,458,400**
3.2 Pressure Control		-	-	-	-													
1) Pressure survey													0				0	**0**
2) Planning of PRV installation point																		
3) PRV Installation	PRV1					1			1				0	4,000,000			4,000,000	**4,000,000**
	PRV2						1		1						4,895,000		4,895,000	**4,895,000**
	PRV3					1			1					779,000			779,000	**779,000**
	PRV4					1			1					6,677,000			6,677,000	**6,677,000**
	PRV5							1	1							3,000,000	3,000,000	**3,000,000**
	63mm					1			1					3,000,000			3,000,000	**3,000,000**
Sub-Total													**0**				**22,351,000**	**22,351,000**
Total													**11,605,200**				**26,204,200**	**37,809,400**
4. Pipe Replacement																		
Total																		**0**
5. Monitoring/Evaluation													0				0	**0**
NRW Rate Calculation		-	-	-	-													
Total													0				0	**0**
Grand Total													**11,605,200**				**54,259,250**	**50,356,400**
																	Without Meter Work	**50,356,400**

Cost - Benefit Analysis in Monthly Base
Kadobogo Pilot Area: PM1
Pipe Replacement

Project Effect 1 : Selling of Surplus Water by NRW Reduction Activity

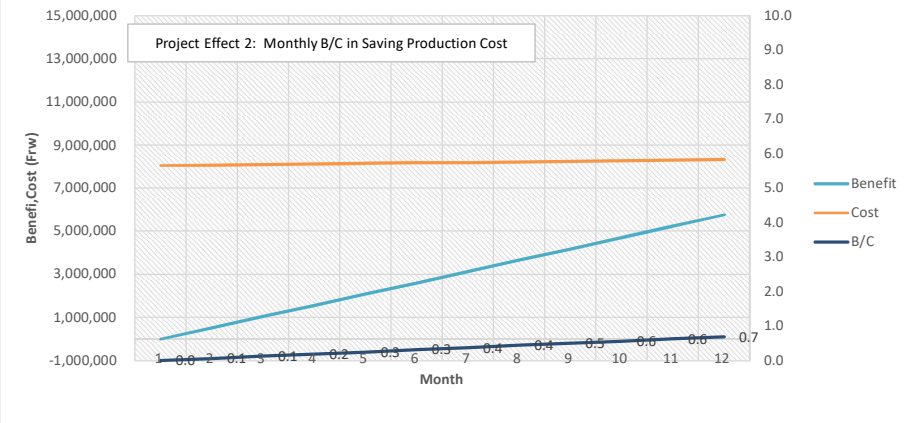
	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	8,052,000	0	8,052,000	-8,052,000	0.0
2	2019/2	930,787	25,440	930,787	8,077,440	-7,146,653	0.1
3	2019/3	930,787	25,440	1,861,574	8,102,880	-6,241,306	0.2
4	2019/4	930,787	25,440	2,792,362	8,128,320	-5,335,958	0.3
5	2019/5	930,787	25,440	3,723,149	8,153,760	-4,430,611	0.5
6	2019/6	930,787	25,440	4,653,936	8,179,200	-3,525,264	0.6
7	2019/7	930,787	25,440	5,584,723	8,204,640	-2,619,917	0.7
8	2019/8	930,787	25,440	6,515,510	8,230,080	-1,714,570	0.8
9	2019/9	930,787	25,440	7,446,298	8,255,520	-809,222	0.9
10	2019/10	930,787	25,440	8,377,085	8,280,960	96,125	1.0
11	2019/11	930,787	25,440	9,307,872	8,306,400	1,001,472	1.1
12	2019/12	930,787	25,440	10,238,659	8,331,840	1,906,819	1.2

Construction Cost		8,052,000
Water Price	Frw/m3	567
Production Cost	Frw/m3	319
Effect Qmnf	m3/h	2.28
Effect Qmnf	m3/month	1,642
Selling Water	Frw/month	930,787
Production Cost Reduction	Frw/month	523,670
Leakage Repair WoP	Times/Mont	5.0
Leakage Repair WP	Times/Mont	1.0
Leakage Repair Cost	Time	25,440



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	8,052,000	0	8,052,000	-8,052,000	0.0
2	2019/2	523,670	25,440	523,670	8,077,440	-7,553,770	0.1
3	2019/3	523,670	25,440	1,047,341	8,102,880	-7,055,539	0.1
4	2019/4	523,670	25,440	1,571,011	8,128,320	-6,557,309	0.2
5	2019/5	523,670	25,440	2,094,682	8,153,760	-6,059,078	0.3
6	2019/6	523,670	25,440	2,618,352	8,179,200	-5,560,848	0.3
7	2019/7	523,670	25,440	3,142,022	8,204,640	-5,062,618	0.4
8	2019/8	523,670	25,440	3,665,693	8,230,080	-4,564,387	0.4
9	2019/9	523,670	25,440	4,189,363	8,255,520	-4,066,157	0.5
10	2019/10	523,670	25,440	4,713,034	8,280,960	-3,567,926	0.6
11	2019/11	523,670	25,440	5,236,704	8,306,400	-3,069,696	0.6
12	2019/12	523,670	25,440	5,760,374	8,331,840	-2,571,466	0.7
13	2019/13	523,670	25,440	6,284,045	8,357,280	-2,073,235	0.8
14	2019/14	523,670	25,440	6,807,715	8,382,720	-1,575,005	0.8
15	2019/15	523,670	25,440	7,331,386	8,408,160	-1,076,774	0.9
16	2019/16	523,670	25,440	7,855,056	8,433,600	-578,544	0.9
17	2019/17	523,670	25,440	8,378,726	8,459,040	-80,314	1.0
18	2019/18	523,670	25,440	8,902,397	8,484,480	417,917	1.0

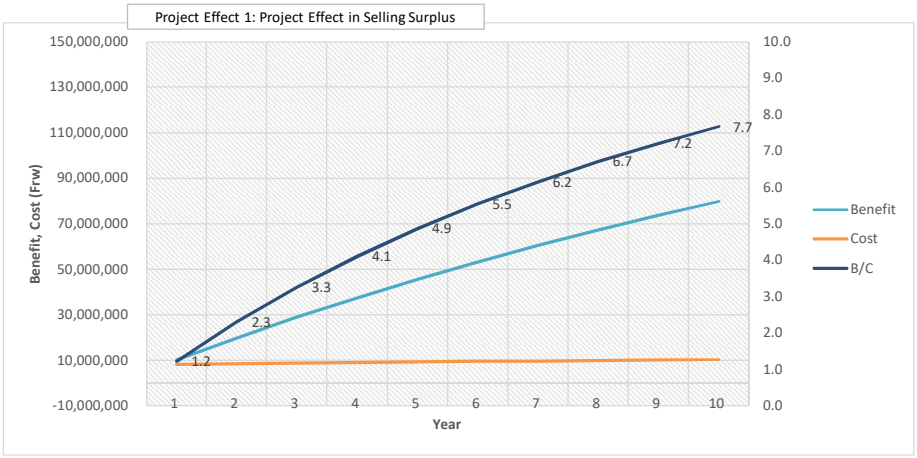


Cost - Benefit Analysis in Yealy Base
Kadobogo Pilot Area PM1
Pipe Replacement

Project Effect 1 : Selling of Surplus Water by NRW Reduction Activity

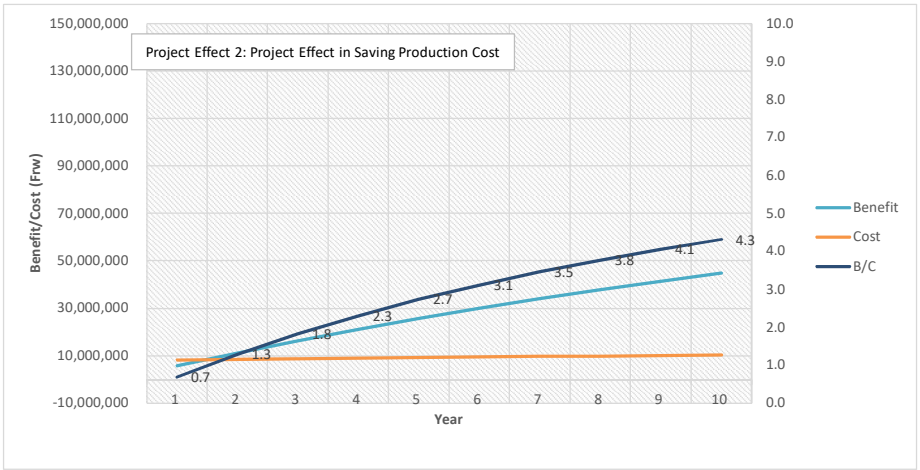
Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	10,238,659	8,331,840	10,238,659	8,331,840	1,906,819	1.2
2	9,659,112	288,000	19,897,772	8,619,840	11,277,932	2.3
3	9,112,370	271,698	29,010,142	8,891,538	20,118,604	3.3
4	8,596,576	256,319	37,606,718	9,147,857	28,458,861	4.1
5	8,109,977	241,810	45,716,695	9,389,667	36,327,027	4.9
6	7,650,922	228,123	53,367,616	9,617,790	43,749,826	5.5
7	7,217,851	215,210	60,585,467	9,833,001	50,752,466	6.2
8	6,809,293	203,029	67,394,760	10,036,029	57,358,731	6.7
9	6,423,861	191,536	73,818,622	10,227,566	63,591,056	7.2
10	6,060,247	180,695	79,878,868	10,408,261	69,470,608	7.7

Discount Rate i %	6.0
Evaluation Period	10
Conversion Factor	$1/(1+i)^n$
0	1.000
1	0.943
2	0.890
3	0.840
4	0.792
5	0.747
6	0.705
7	0.665
8	0.627
9	0.592



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	5,760,374	8,331,840	5,760,374	8,331,840	-2,571,466	0.7
2	5,434,315	288,000	11,194,690	8,619,840	2,574,850	1.3
3	5,126,713	271,698	16,321,403	8,891,538	7,429,864	1.8
4	4,836,521	256,319	21,157,924	9,147,857	12,010,067	2.3
5	4,562,756	241,810	25,720,680	9,389,667	16,331,013	2.7
6	4,304,487	228,123	30,025,167	9,617,790	20,407,376	3.1
7	4,060,837	215,210	34,086,004	9,833,001	24,253,003	3.5
8	3,830,978	203,029	37,916,982	10,036,029	27,880,952	3.8
9	3,614,130	191,536	41,531,112	10,227,566	31,303,546	4.1
10	3,409,557	180,695	44,940,668	10,408,261	34,532,408	4.3

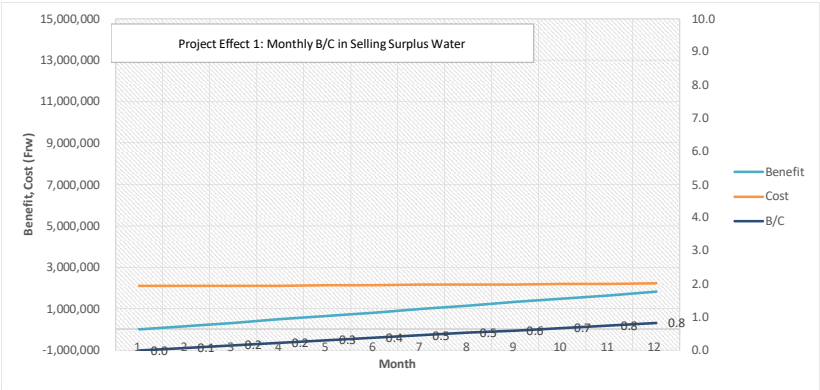


Cost - Benefit Analysis in Monthly Base
Kadobogo Pilot Area: PM2
PRV2

Project Effect 1 : Selling of Surplus Water by NRW Reduction Activity

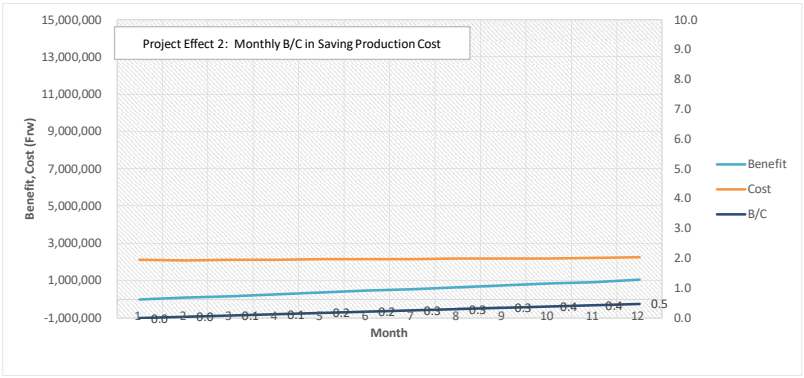
	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	2,099,000	0	2,099,000	-2,099,000	0.0
2	2019/2	167,378	12,720	167,378	2,111,720	-1,944,342	0.1
3	2019/3	167,378	12,720	334,757	2,124,440	-1,789,683	0.2
4	2019/4	167,378	12,720	502,135	2,137,160	-1,635,025	0.2
5	2019/5	167,378	12,720	669,514	2,149,880	-1,480,366	0.3
6	2019/6	167,378	12,720	836,892	2,162,600	-1,325,708	0.4
7	2019/7	167,378	12,720	1,004,270	2,175,320	-1,171,050	0.5
8	2019/8	167,378	12,720	1,171,649	2,188,040	-1,016,391	0.5
9	2019/9	167,378	12,720	1,339,027	2,200,760	-861,733	0.6
10	2019/10	167,378	12,720	1,506,406	2,213,480	-707,074	0.7
11	2019/11	167,378	12,720	1,673,784	2,226,200	-552,416	0.8
12	2019/12	167,378	12,720	1,841,162	2,238,920	-397,758	0.8
13	2019/13	167,378	12,720	2,008,541	2,251,640	-243,099	0.9
14	2019/14	167,378	12,720	2,175,919	2,264,360	-88,441	1.0

Construction Cost		2,099,000
Water Price	Frw/m3	567
Production Cost	Frw/m3	319
Effect Qmnf	m3/h	0.41
Effect Qmnf	m3/month	295
Selling Water	Frw/month	167,378
Production Cost Reduction	Frw/month	94,169
Leakage Repair WoP	Times/Mont	2.1
Leakage Repair WP	Times/Mont	0.5
Leakage Repair Cost	Time	25,440



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	2,099,000	0	2,099,000	-2,099,000	0.0
2	2019/2	94,169	12,720	94,169	2,111,720	-2,017,551	0.0
3	2019/3	94,169	12,720	188,338	2,124,440	-1,936,102	0.1
4	2019/4	94,169	12,720	282,506	2,137,160	-1,854,654	0.1
5	2019/5	94,169	12,720	376,675	2,149,880	-1,773,205	0.2
6	2019/6	94,169	12,720	470,844	2,162,600	-1,691,756	0.2
7	2019/7	94,169	12,720	565,013	2,175,320	-1,610,307	0.3
8	2019/8	94,169	12,720	659,182	2,188,040	-1,528,858	0.3
9	2019/9	94,169	12,720	753,350	2,200,760	-1,447,410	0.3
10	2019/10	94,169	12,720	847,519	2,213,480	-1,365,961	0.4
11	2019/11	94,169	12,720	941,688	2,226,200	-1,284,512	0.4
12	2019/12	94,169	12,720	1,035,857	2,238,920	-1,203,063	0.5
13	2019/13	94,169	12,720	1,130,026	2,251,640	-1,121,614	0.5
14	2019/14	94,169	12,720	1,224,194	2,264,360	-1,040,166	0.5
15	2019/15	94,169	12,720	1,318,363	2,277,080	-958,717	0.6
16	2019/16	94,169	12,720	1,412,532	2,289,800	-877,268	0.6
17	2019/17	94,169	12,720	1,506,701	2,302,520	-795,819	0.7
18	2019/18	94,169	12,720	1,600,870	2,315,240	-714,370	0.7
19	2019/19	94,169	12,720	1,695,038	2,327,960	-632,922	0.7
20	2019/20	94,169	12,720	1,789,207	2,340,680	-551,473	0.8
21	2019/21	94,169	12,720	1,883,376	2,353,400	-470,024	0.8
22	2019/22	94,169	12,720	1,977,545	2,366,120	-388,575	0.8
23	2019/23	94,169	12,720	2,071,714	2,378,840	-307,126	0.9
24	2019/24	94,169	12,720	2,165,882	2,391,560	-225,678	0.9
25	2019/25	94,169	12,720	2,260,051	2,404,280	-144,229	0.9
26	2019/26	94,169	12,720	2,354,220	2,417,000	-62,780	1.0

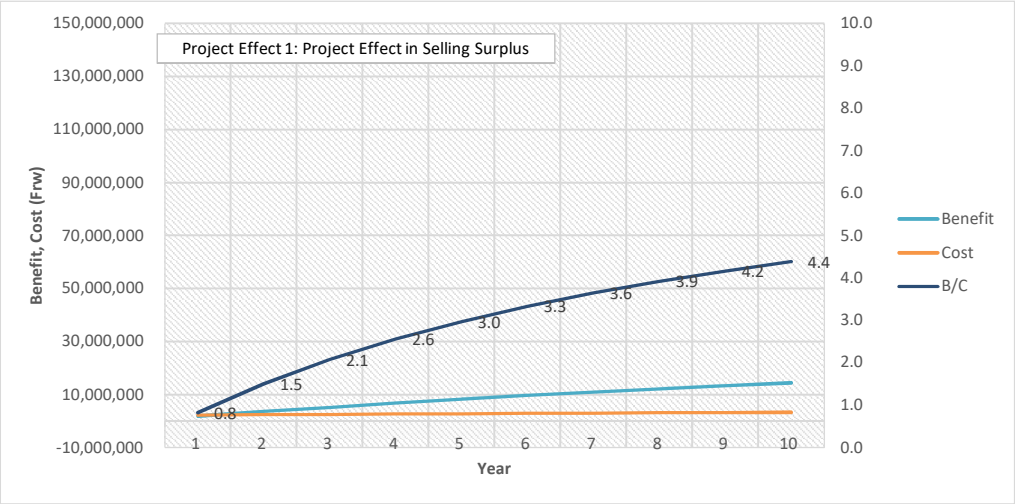


Cost - Benefit Analysis in Yealy Base
Kadobogo Pilot Area: PM2
PRV2

Project Effect 1: Selling of Surplus Water by NRW Reduction Activity

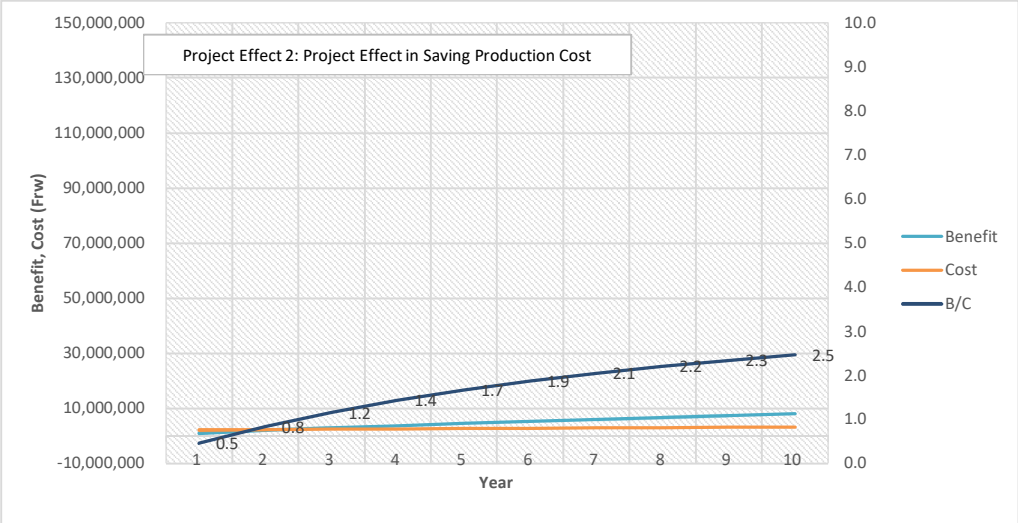
Discount Rate i %	6.0
Evaluation Period	10
Conversion Factor	$1/(1+i)^{\wedge n}$

Year	Benefit	Cost	Effect of the Action				Conversion Factor	$1/(1+i)^{\wedge n}$
			Benefit	Cost	NPV	B/C		
1	1,841,162	2,238,920	1,841,162	2,238,920	-397,758	0.8	0	1.000
2	1,736,946	144,000	3,578,108	2,382,920	1,195,188	1.5	1	0.943
3	1,638,628	135,849	5,216,736	2,518,769	2,697,967	2.1	2	0.890
4	1,545,875	128,159	6,762,611	2,646,929	4,115,683	2.6	3	0.840
5	1,458,373	120,905	8,220,985	2,767,834	5,453,151	3.0	4	0.792
6	1,375,824	114,061	9,596,808	2,881,895	6,714,913	3.3	5	0.747
7	1,297,947	107,605	10,894,755	2,989,500	7,905,255	3.6	6	0.705
8	1,224,478	101,514	12,119,233	3,091,015	9,028,219	3.9	7	0.665
9	1,155,168	95,768	13,274,401	3,186,783	10,087,618	4.2	8	0.627
10	1,089,781	90,347	14,364,182	3,277,130	11,087,052	4.4	9	0.592



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	1,035,857	2,238,920	1,035,857	2,238,920	-1,203,063	0.5
2	977,223	144,000	2,013,080	2,382,920	-369,840	0.8
3	921,909	135,849	2,934,989	2,518,769	416,220	1.2
4	869,725	128,159	3,804,714	2,646,929	1,157,786	1.4
5	820,496	120,905	4,625,210	2,767,834	1,857,376	1.7
6	774,052	114,061	5,399,262	2,881,895	2,517,367	1.9
7	730,238	107,605	6,129,501	2,989,500	3,140,000	2.1
8	688,904	101,514	6,818,405	3,091,015	3,727,390	2.2
9	649,909	95,768	7,468,314	3,186,783	4,281,531	2.3
10	613,122	90,347	8,081,436	3,277,130	4,804,306	2.5

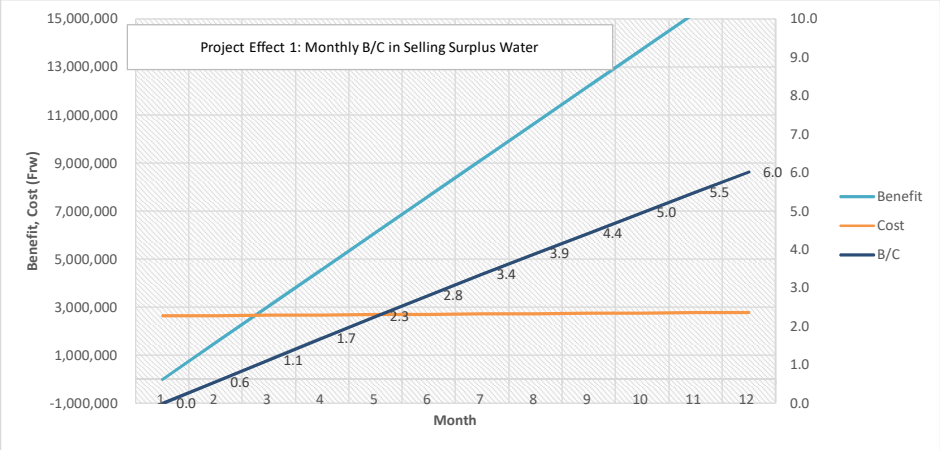


Cost - Benefit Analysis in Monthly Base
Kadobogo Pilot Area: PM3
PRV3

Project Effect 1 : Selling of Surplus Water by NRW Reduction Activity

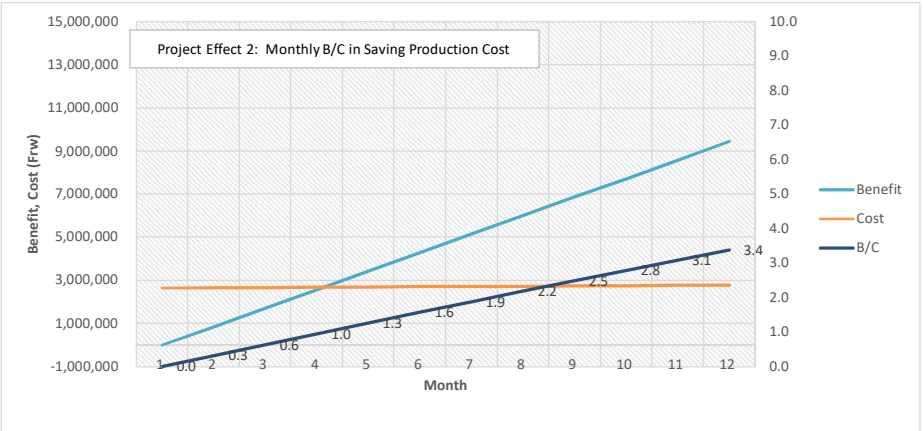
	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	2,649,000	0	2,649,000	-2,649,000	0.0
2	2019/2	1,526,818	12,720	1,526,818	2,661,720	-1,134,902	0.6
3	2019/3	1,526,818	12,720	3,053,635	2,674,440	379,195	1.1
4	2019/4	1,526,818	12,720	4,580,453	2,687,160	1,893,293	1.7
5	2019/5	1,526,818	12,720	6,107,270	2,699,880	3,407,390	2.3
6	2019/6	1,526,818	12,720	7,634,088	2,712,600	4,921,488	2.8
7	2019/7	1,526,818	12,720	9,160,906	2,725,320	6,435,586	3.4
8	2019/8	1,526,818	12,720	10,687,723	2,738,040	7,949,683	3.9
9	2019/9	1,526,818	12,720	12,214,541	2,750,760	9,463,781	4.4
10	2019/10	1,526,818	12,720	13,741,358	2,763,480	10,977,878	5.0
11	2019/11	1,526,818	12,720	15,268,176	2,776,200	12,491,976	5.5
12	2019/12	1,526,818	12,720	16,794,994	2,788,920	14,006,074	6.0

Construction Cost		2,649,000
Water Price	Frw/m3	567
Production Cost	Frw/m3	319
Effect Qmnf	m3/h	3.74
Effect Qmnf	m3/month	2,693
Selling Water	Frw/month	1,526,818
Production Cost Reduction	Frw/month	859,003
Leakage Repair WoP	Times/Mont	3.3
Leakage Repair WP	Times/Mont	0.5
Leakage Repair Cost	Time	25,440



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	2,649,000	0	2,649,000	-2,649,000	0.0
2	2019/2	859,003	12,720	859,003	2,661,720	-1,802,717	0.3
3	2019/3	859,003	12,720	1,718,006	2,674,440	-956,434	0.6
4	2019/4	859,003	12,720	2,577,010	2,687,160	-110,150	1.0
5	2019/5	859,003	12,720	3,436,013	2,699,880	736,133	1.3
6	2019/6	859,003	12,720	4,295,016	2,712,600	1,582,416	1.6
7	2019/7	859,003	12,720	5,154,019	2,725,320	2,428,699	1.9
8	2019/8	859,003	12,720	6,013,022	2,738,040	3,274,982	2.2
9	2019/9	859,003	12,720	6,872,026	2,750,760	4,121,266	2.5
10	2019/10	859,003	12,720	7,731,029	2,763,480	4,967,549	2.8
11	2019/11	859,003	12,720	8,590,032	2,776,200	5,813,832	3.1
12	2019/12	859,003	12,720	9,449,035	2,788,920	6,660,115	3.4

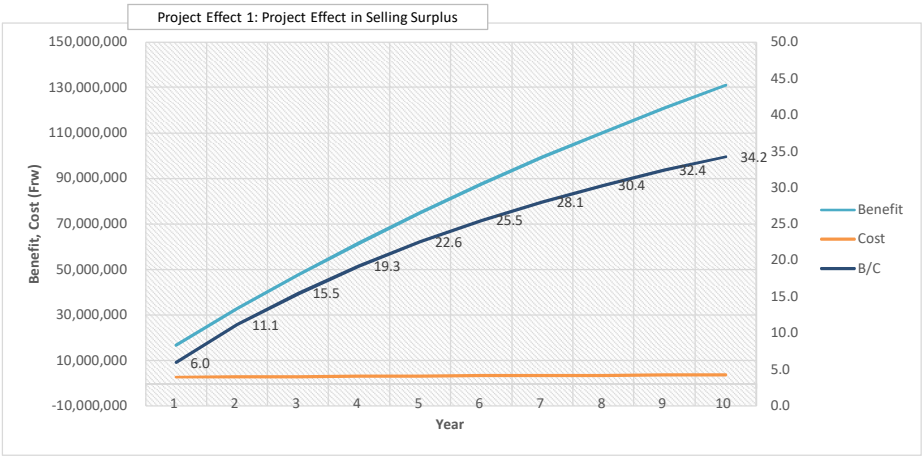


Cost - Benefit Analysis in Yealy Base
Kadobogo Pilot Area: PM3
PRV3

Project Effect 1: Selling of Surplus Water by NRW Reduction Activity

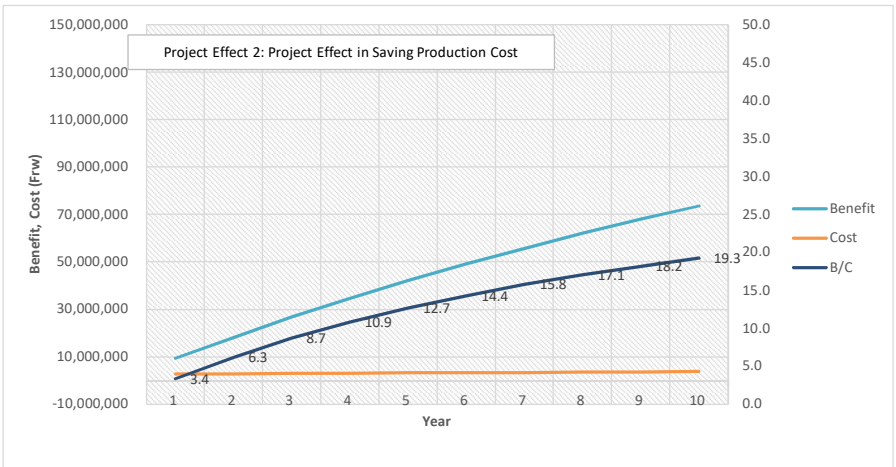
Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	16,794,994	2,788,920	16,794,994	2,788,920	14,006,074	6.0
2	15,844,334	144,000	32,639,327	2,932,920	29,706,407	11.1
3	14,947,485	135,849	47,586,812	3,068,769	44,518,043	15.5
4	14,101,400	128,159	61,688,212	3,196,929	58,491,284	19.3
5	13,303,208	120,905	74,991,420	3,317,834	71,673,586	22.6
6	12,550,196	114,061	87,541,616	3,431,895	84,109,721	25.5
7	11,839,808	107,605	99,381,424	3,539,500	95,841,924	28.1
8	11,169,630	101,514	110,551,054	3,641,015	106,910,039	30.4
9	10,537,387	95,768	121,088,441	3,736,783	117,351,658	32.4
10	9,940,931	90,347	131,029,372	3,827,130	127,202,242	34.2

Discount Rate i %	6.0
Evaluation Period	10
Conversion Factor	$1/(1+i)^n$
0	1.000
1	0.943
2	0.890
3	0.840
4	0.792
5	0.747
6	0.705
7	0.665
8	0.627
9	0.592



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	9,449,035	2,788,920	9,449,035	2,788,920	6,660,115	3.4
2	8,914,184	144,000	18,363,219	2,932,920	15,430,299	6.3
3	8,409,608	135,849	26,772,827	3,068,769	23,704,058	8.7
4	7,933,592	128,159	34,706,419	3,196,929	31,509,491	10.9
5	7,484,521	120,905	42,190,940	3,317,834	38,873,106	12.7
6	7,060,869	114,061	49,251,809	3,431,895	45,819,914	14.4
7	6,661,197	107,605	55,913,006	3,539,500	52,373,505	15.8
8	6,284,148	101,514	62,197,154	3,641,015	58,556,139	17.1
9	5,928,442	95,768	68,125,596	3,736,783	64,388,813	18.2
10	5,592,869	90,347	73,718,465	3,827,130	69,891,335	19.3



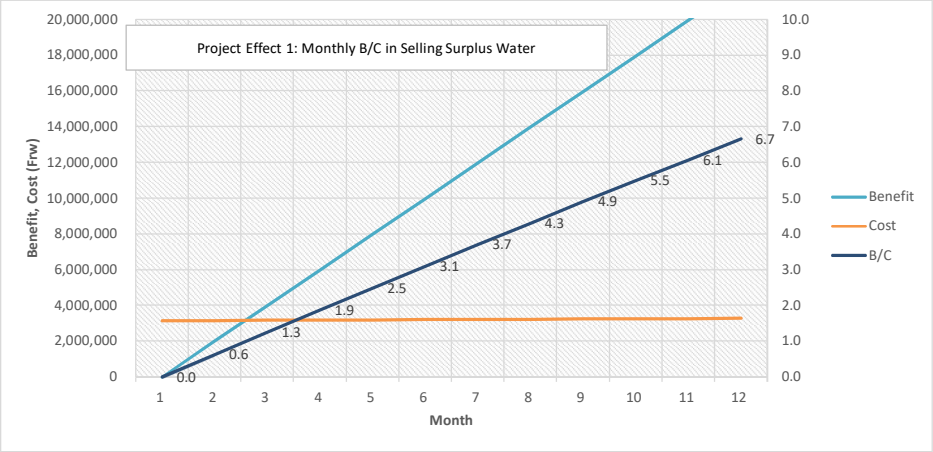
Cost - Benefit Analysis in Monthly Base

Ruyenzi Pilot Area RY1
PRV1

Project Effect 1: Selling of Surplus Water by NRW Reduction Activity

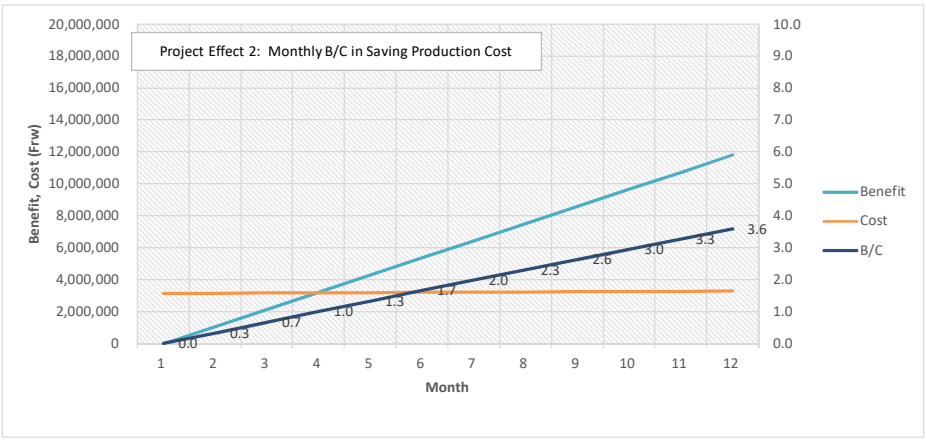
	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	3,153,000	0	3,153,000	-3,153,000	0.0
2	2019/2	1,994,803	12,720	1,994,803	3,165,720	-1,170,917	0.6
3	2019/3	1,994,803	12,720	3,989,606	3,178,440	811,166	1.3
4	2019/4	1,994,803	12,720	5,984,410	3,191,160	2,793,250	1.9
5	2019/5	1,994,803	12,720	7,979,213	3,203,880	4,775,333	2.5
6	2019/6	1,994,803	12,720	9,974,016	3,216,600	6,757,416	3.1
7	2019/7	1,994,803	12,720	11,968,819	3,229,320	8,739,499	3.7
8	2019/8	1,994,803	12,720	13,963,622	3,242,040	10,721,582	4.3
9	2019/9	1,994,803	12,720	15,958,426	3,254,760	12,703,666	4.9
10	2019/10	1,994,803	12,720	17,953,229	3,267,480	14,685,749	5.5
11	2019/11	1,994,803	12,720	19,948,032	3,280,200	16,667,832	6.1
12	2019/12	1,994,803	12,720	21,942,835	3,292,920	18,649,915	6.7

Construction Cost		3,153,000
Water Price	Frw/m3	592
Production Cost	Frw/m3	319
Effect Qmnf		4.68
Effect Qmnf	m3/month	3,370
Selling Water	Frw/month	1,994,803
Production Cost Reduction	Frw/month	1,074,902
Leakage Repair WoP	Times/Mont	6.0
Leakage Repair WP	Times/Mont	0.5
Leakage Repair Cost	Time	25,440



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	3,153,000	0	3,153,000	-3,153,000	0.0
2	2019/2	1,074,902	12,720	1,074,902	3,165,720	-2,090,818	0.3
3	2019/3	1,074,902	12,720	2,149,805	3,178,440	-1,028,635	0.7
4	2019/4	1,074,902	12,720	3,224,707	3,191,160	33,547	1.0
5	2019/5	1,074,902	12,720	4,299,610	3,203,880	1,095,730	1.3
6	2019/6	1,074,902	12,720	5,374,512	3,216,600	2,157,912	1.7
7	2019/7	1,074,902	12,720	6,449,414	3,229,320	3,220,094	2.0
8	2019/8	1,074,902	12,720	7,524,317	3,242,040	4,282,277	2.3
9	2019/9	1,074,902	12,720	8,599,219	3,254,760	5,344,459	2.6
10	2019/10	1,074,902	12,720	9,674,122	3,267,480	6,406,642	3.0
11	2019/11	1,074,902	12,720	10,749,024	3,280,200	7,468,824	3.3
12	2019/12	1,074,902	12,720	11,823,926	3,292,920	8,531,006	3.6

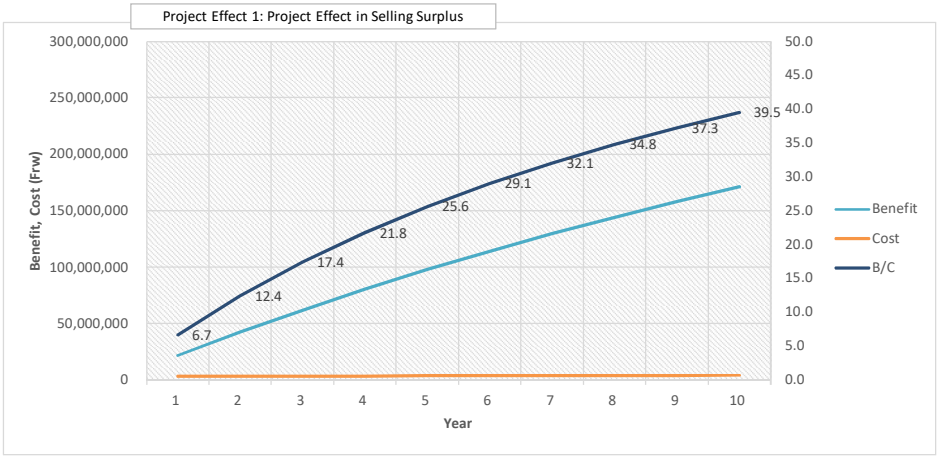


Cost - Benefit Analysis in Yealy Base
Ruyenzi Pilot Area
PRV1

Project Effect 1 : Selling of Surplus Water by NRW Reduction Activity

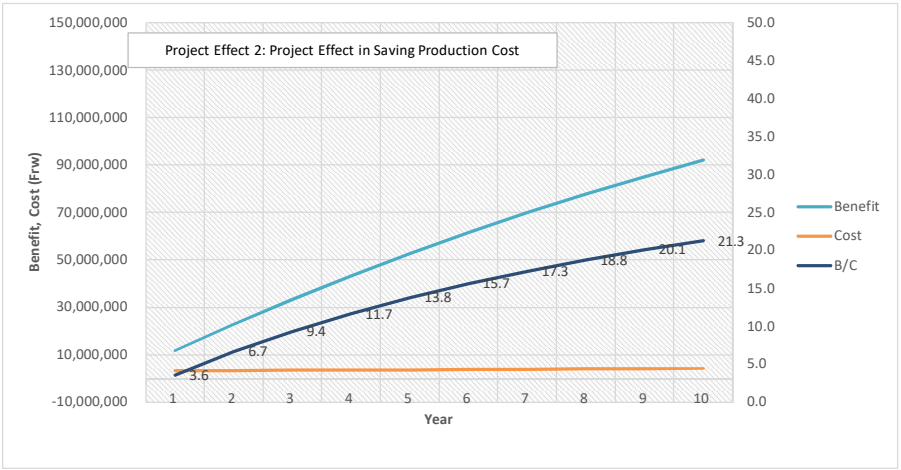
Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	21,942,835	3,292,920	21,942,835	3,292,920	18,649,915	6.7
2	20,700,788	144,000	42,643,623	3,436,920	39,206,703	12.4
3	19,529,045	135,849	62,172,668	3,572,769	58,599,899	17.4
4	18,423,628	128,159	80,596,296	3,700,929	76,895,367	21.8
5	17,380,781	120,905	97,977,077	3,821,834	94,155,243	25.6
6	16,396,963	114,061	114,374,040	3,935,895	110,438,144	29.1
7	15,468,833	107,605	129,842,873	4,043,500	125,799,372	32.1
8	14,593,239	101,514	144,436,111	4,145,015	140,291,096	34.8
9	13,767,206	95,768	158,203,317	4,240,783	153,962,534	37.3
10	12,987,930	90,347	171,191,248	4,331,130	166,860,118	39.5

Discount Rate i %	6.0
Evaluation Period	10
Conversion Factor	$1/(1+i)^n$
0	1.000
1	0.943
2	0.890
3	0.840
4	0.792
5	0.747
6	0.705
7	0.665
8	0.627
9	0.592



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	11,823,926	3,292,920	11,823,926	3,292,920	8,531,006	3.6
2	11,154,648	144,000	22,978,574	3,436,920	19,541,654	6.7
3	10,523,252	135,849	33,501,826	3,572,769	29,929,057	9.4
4	9,927,597	128,159	43,429,423	3,700,929	39,728,494	11.7
5	9,365,657	120,905	52,795,080	3,821,834	48,973,246	13.8
6	8,835,526	114,061	61,630,606	3,935,895	57,694,711	15.7
7	8,335,402	107,605	69,966,007	4,043,500	65,922,507	17.3
8	7,863,586	101,514	77,829,594	4,145,015	73,684,579	18.8
9	7,418,478	95,768	85,248,071	4,240,783	81,007,288	20.1
10	6,998,564	90,347	92,246,635	4,331,130	87,915,505	21.3

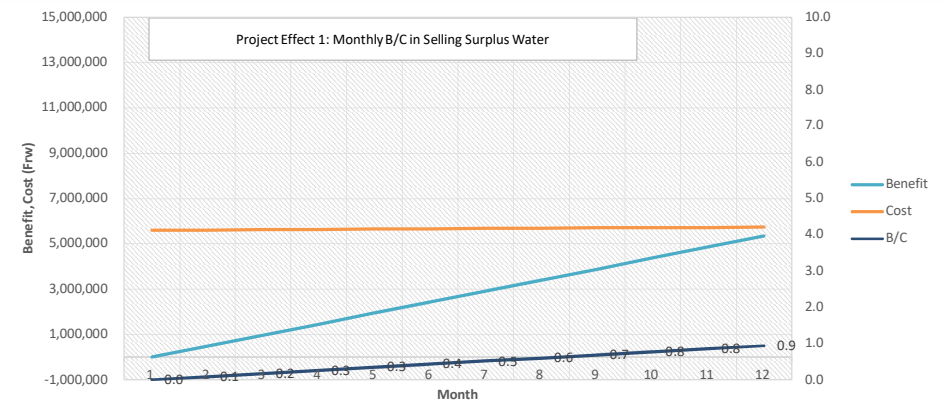


Cost - Benefit Analysis in Monthly Base
Ruyenzi Pilot Area RY2
PRV2

Project Effect 1: Selling of Surplus Water by NRW Reduction Activity

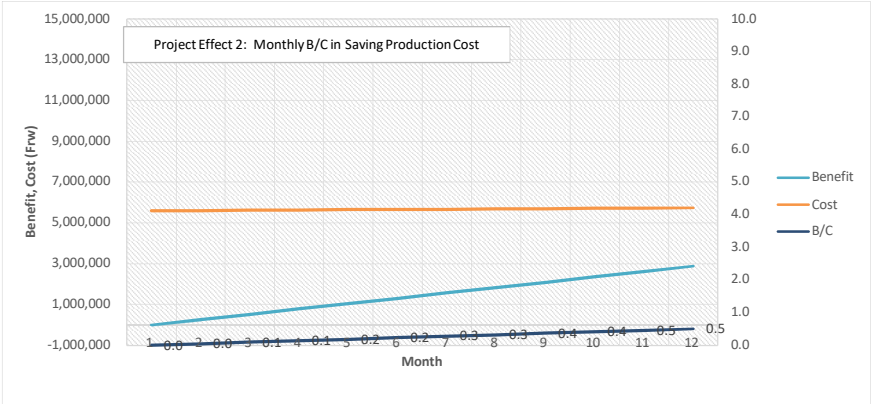
	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	5,599,000	0	5,599,000	-5,599,000	0.0
2	2019/2	485,914	12,720	485,914	5,611,720	-5,125,806	0.1
3	2019/3	485,914	12,720	971,827	5,624,440	-4,652,613	0.2
4	2019/4	485,914	12,720	1,457,741	5,637,160	-4,179,419	0.3
5	2019/5	485,914	12,720	1,943,654	5,649,880	-3,706,226	0.3
6	2019/6	485,914	12,720	2,429,568	5,662,600	-3,233,032	0.4
7	2019/7	485,914	12,720	2,915,482	5,675,320	-2,759,838	0.5
8	2019/8	485,914	12,720	3,401,395	5,688,040	-2,286,645	0.6
9	2019/9	485,914	12,720	3,887,309	5,700,760	-1,813,451	0.7
10	2019/10	485,914	12,720	4,373,222	5,713,480	-1,340,258	0.8
11	2019/11	485,914	12,720	4,859,136	5,726,200	-867,064	0.8
12	2019/12	485,914	12,720	5,345,050	5,738,920	-393,870	0.9
13	2019/13	485,914	12,720	5,830,963	5,751,640	79,323	1.0
14	2019/14	485,914	12,720	6,316,877	5,764,360	552,517	1.1

Construction Cost		5,599,000
Water Price	Frw/m3	592
Production Cost	Frw/m3	319
Effect Qmnf	m3/h	1.14
Effect Qmnf	m3/month	821
Selling Water	Frw/month	485,914
Production Cost Reduction	Frw/month	261,835
Leakage Repair WoP	Times/Mont	2.0
Leakage Repair WP	Times/Mont	0.5
Leakage Repair Cost	Time	25,440



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	5,599,000	0	5,599,000	-5,599,000	0.0
2	2019/2	261,835	12,720	261,835	5,611,720	-5,349,885	0.0
3	2019/3	261,835	12,720	523,670	5,624,440	-5,100,770	0.1
4	2019/4	261,835	12,720	785,506	5,637,160	-4,851,654	0.1
5	2019/5	261,835	12,720	1,047,341	5,649,880	-4,602,539	0.2
6	2019/6	261,835	12,720	1,309,176	5,662,600	-4,353,424	0.2
7	2019/7	261,835	12,720	1,571,011	5,675,320	-4,104,309	0.3
8	2019/8	261,835	12,720	1,832,846	5,688,040	-3,855,194	0.3
9	2019/9	261,835	12,720	2,094,682	5,700,760	-3,606,078	0.4
10	2019/10	261,835	12,720	2,356,517	5,713,480	-3,356,963	0.4
11	2019/11	261,835	12,720	2,618,352	5,726,200	-3,107,848	0.5
12	2019/12	261,835	12,720	2,880,187	5,738,920	-2,858,733	0.5
13	2019/13	261,835	12,720	3,142,022	5,751,640	-2,609,618	0.5
14	2019/14	261,835	12,720	3,403,858	5,764,360	-2,360,502	0.6
15	2019/15	261,835	12,720	3,665,693	5,777,080	-2,111,387	0.6
16	2019/16	261,835	12,720	3,927,528	5,789,800	-1,862,272	0.7
17	2019/17	261,835	12,720	4,189,363	5,802,520	-1,613,157	0.7
18	2019/18	261,835	12,720	4,451,198	5,815,240	-1,364,042	0.8
19	2019/19	261,835	12,720	4,713,034	5,827,960	-1,114,926	0.8
20	2019/20	261,835	12,720	4,974,869	5,840,680	-865,811	0.9
21	2019/21	261,835	12,720	5,236,704	5,853,400	-616,696	0.9
22	2019/22	261,835	12,720	5,498,539	5,866,120	-367,581	0.9
23	2019/23	261,835	12,720	5,760,374	5,878,840	-118,466	1.0

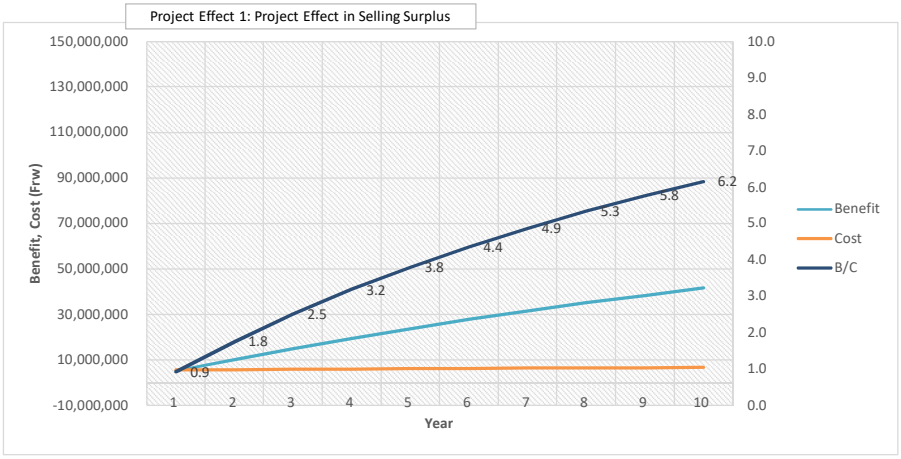


Cost - Benefit Analysis in Yealy Base
Ruyenzi Pilot Area RY1
PRV2

Project Effect 1: Selling of Surplus Water by NRW Reduction Activity

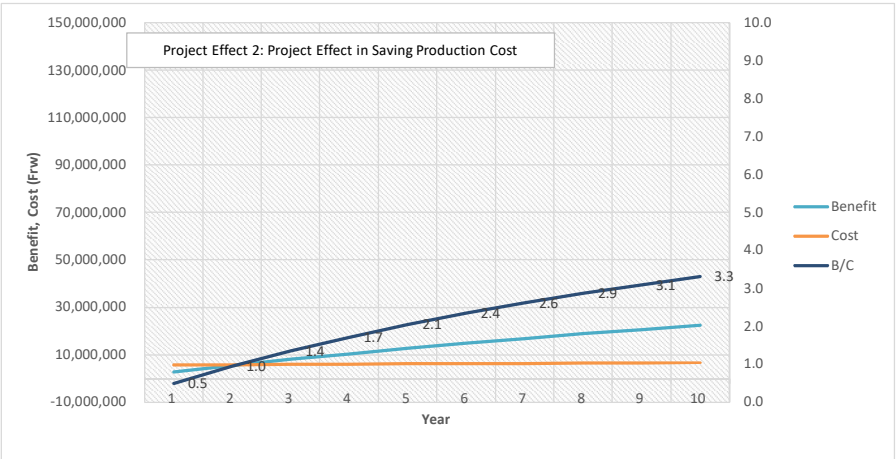
Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	5,345,050	5,738,920	5,345,050	5,738,920	-393,870	0.9
2	5,042,500	144,000	10,387,549	5,882,920	4,504,629	1.8
3	4,757,075	135,849	15,144,624	6,018,769	9,125,855	2.5
4	4,487,807	128,159	19,632,431	6,146,929	13,485,503	3.2
5	4,233,780	120,905	23,866,211	6,267,834	17,598,377	3.8
6	3,994,132	114,061	27,860,343	6,381,895	21,478,448	4.4
7	3,768,049	107,605	31,628,392	6,489,500	25,138,892	4.9
8	3,554,763	101,514	35,183,155	6,591,015	28,592,141	5.3
9	3,353,550	95,768	38,536,706	6,686,783	31,849,923	5.8
10	3,163,727	90,347	41,700,432	6,777,130	34,923,302	6.2

Discount Rate i %	6.0
Evaluation Period	10
Conversion Factor	$1/(1+i)^n$
0	1.000
1	0.943
2	0.890
3	0.840
4	0.792
5	0.747
6	0.705
7	0.665
8	0.627
9	0.592



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	2,880,187	5,738,920	2,880,187	5,738,920	-2,858,733	0.5
2	2,717,158	144,000	5,597,345	5,882,920	-285,575	1.0
3	2,563,356	135,849	8,160,701	6,018,769	2,141,932	1.4
4	2,418,261	128,159	10,578,962	6,146,929	4,432,033	1.7
5	2,281,378	120,905	12,860,340	6,267,834	6,592,506	2.1
6	2,152,243	114,061	15,012,583	6,381,895	8,630,688	2.4
7	2,030,418	107,605	17,043,002	6,489,500	10,553,501	2.6
8	1,915,489	101,514	18,958,491	6,591,015	12,367,476	2.9
9	1,807,065	95,768	20,765,556	6,686,783	14,078,773	3.1
10	1,704,778	90,347	22,470,334	6,777,130	15,693,204	3.3

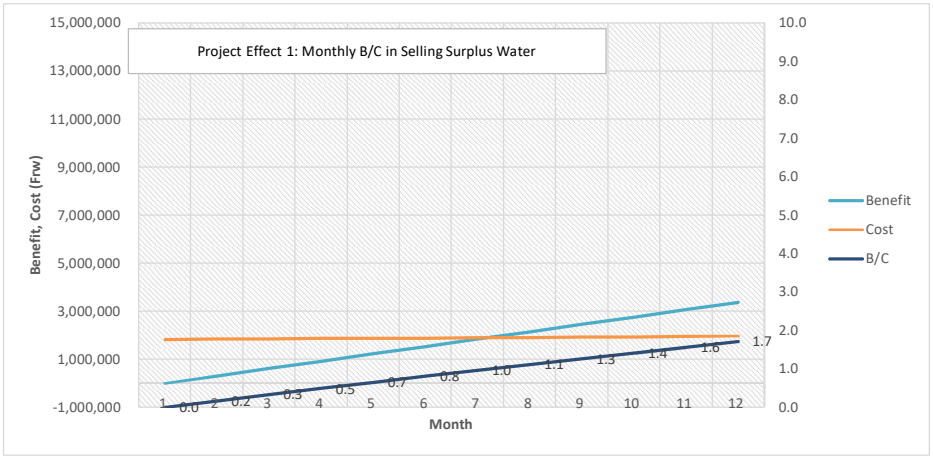


Cost - Benefit Analysis in Monthly Base
Ruyenzi Pilot Area RY1
PRV3

Project Effect 1 : Selling of Surplus Water by NRW Reduction Activity

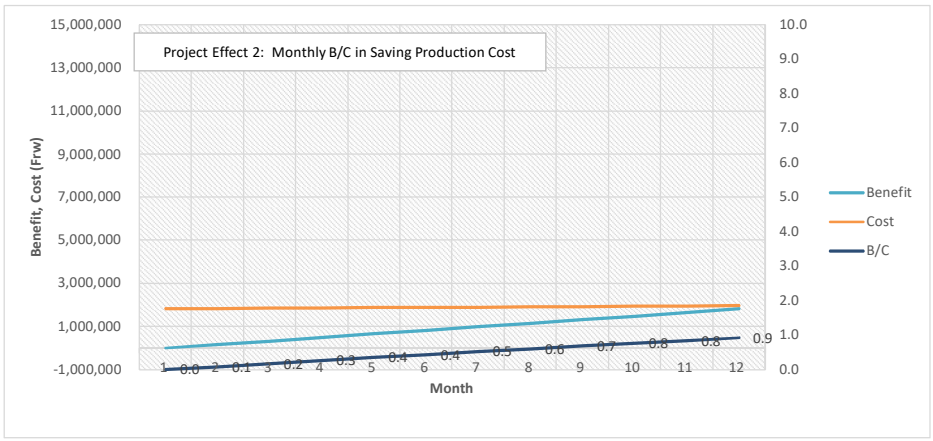
	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	1,829,000	0	1,829,000	-1,829,000	0.0
2	2019/2	306,893	12,720	306,893	1,841,720	-1,534,827	0.2
3	2019/3	306,893	12,720	613,786	1,854,440	-1,240,654	0.3
4	2019/4	306,893	12,720	920,678	1,867,160	-946,482	0.5
5	2019/5	306,893	12,720	1,227,571	1,879,880	-652,309	0.7
6	2019/6	306,893	12,720	1,534,464	1,892,600	-358,136	0.8
7	2019/7	306,893	12,720	1,841,357	1,905,320	-63,963	1.0
8	2019/8	306,893	12,720	2,148,250	1,918,040	230,210	1.1
9	2019/9	306,893	12,720	2,455,142	1,930,760	524,382	1.3
10	2019/10	306,893	12,720	2,762,035	1,943,480	818,555	1.4
11	2019/11	306,893	12,720	3,068,928	1,956,200	1,112,728	1.6
12	2019/12	306,893	12,720	3,375,821	1,968,920	1,406,901	1.7

Construction Cost		1,829,000
Water Price	Frw/m3	592
Production Cost	Frw/m3	319
Effect Qmnf	m3/h	0.72
Effect Qmnf	m3/month	518
Selling Water	Frw/month	306,893
Production Cost Reduction	Frw/month	165,370
Leakage Repair WoP	Times/Mont	2.0
Leakage Repair WP	Times/Mont	0.5
Leakage Repair Cost	RWF/Time	25,440



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

	Month	Benefit	Cost	Effect of the Action			
				Benefit	Cost	NPV	B/C
1	2019/1	0	1,829,000	0	1,829,000	-1,829,000	0.0
2	2019/2	165,370	12,720	165,370	1,841,720	-1,676,350	0.1
3	2019/3	165,370	12,720	330,739	1,854,440	-1,523,701	0.2
4	2019/4	165,370	12,720	496,109	1,867,160	-1,371,051	0.3
5	2019/5	165,370	12,720	661,478	1,879,880	-1,218,402	0.4
6	2019/6	165,370	12,720	826,848	1,892,600	-1,065,752	0.4
7	2019/7	165,370	12,720	992,218	1,905,320	-913,102	0.5
8	2019/8	165,370	12,720	1,157,587	1,918,040	-760,453	0.6
9	2019/9	165,370	12,720	1,322,957	1,930,760	-607,803	0.7
10	2019/10	165,370	12,720	1,488,326	1,943,480	-455,154	0.8
11	2019/11	165,370	12,720	1,653,696	1,956,200	-302,504	0.8
12	2019/12	165,370	12,720	1,819,066	1,968,920	-149,854	0.9



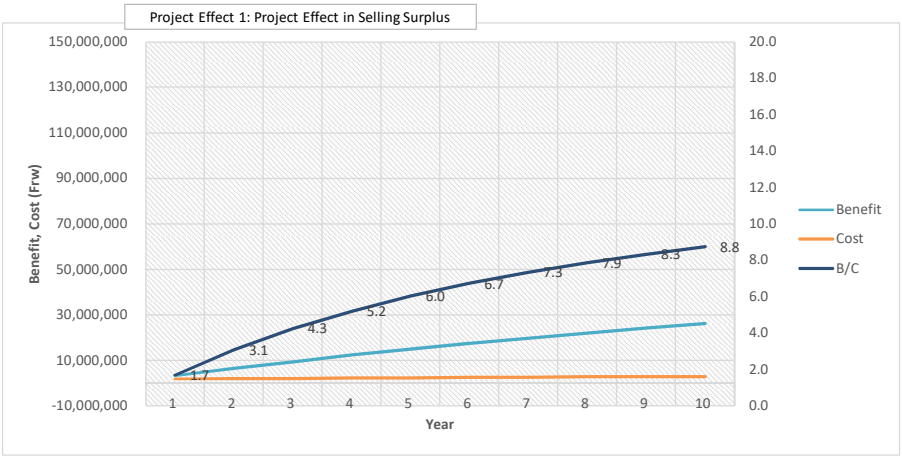
Cost - Benefit Analysis in Yealy Base
Ruyenzi Pilot Area: RY1
PRV3

Project Effect 1: Selling of Surplus Water by NRW Reduction Activity

Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	3,375,821	1,968,920	3,375,821	1,968,920	1,406,901	1.7
2	3,184,737	144,000	6,560,557	2,112,920	4,447,637	3.1
3	3,004,468	135,849	9,565,026	2,248,769	7,316,257	4.3
4	2,834,404	128,159	12,399,430	2,376,929	10,022,502	5.2
5	2,673,966	120,905	15,073,396	2,497,834	12,575,563	6.0
6	2,522,610	114,061	17,596,006	2,611,895	14,984,111	6.7
7	2,379,820	107,605	19,975,827	2,719,500	17,256,326	7.3
8	2,245,114	101,514	22,220,940	2,821,015	19,399,925	7.9
9	2,118,032	95,768	24,338,972	2,916,783	21,422,189	8.3
10	1,998,143	90,347	26,337,115	3,007,130	23,329,985	8.8

Discount Rate i %	6.0
Evaluation Period	10
Conversion Factor	$1/(1+i)^n$

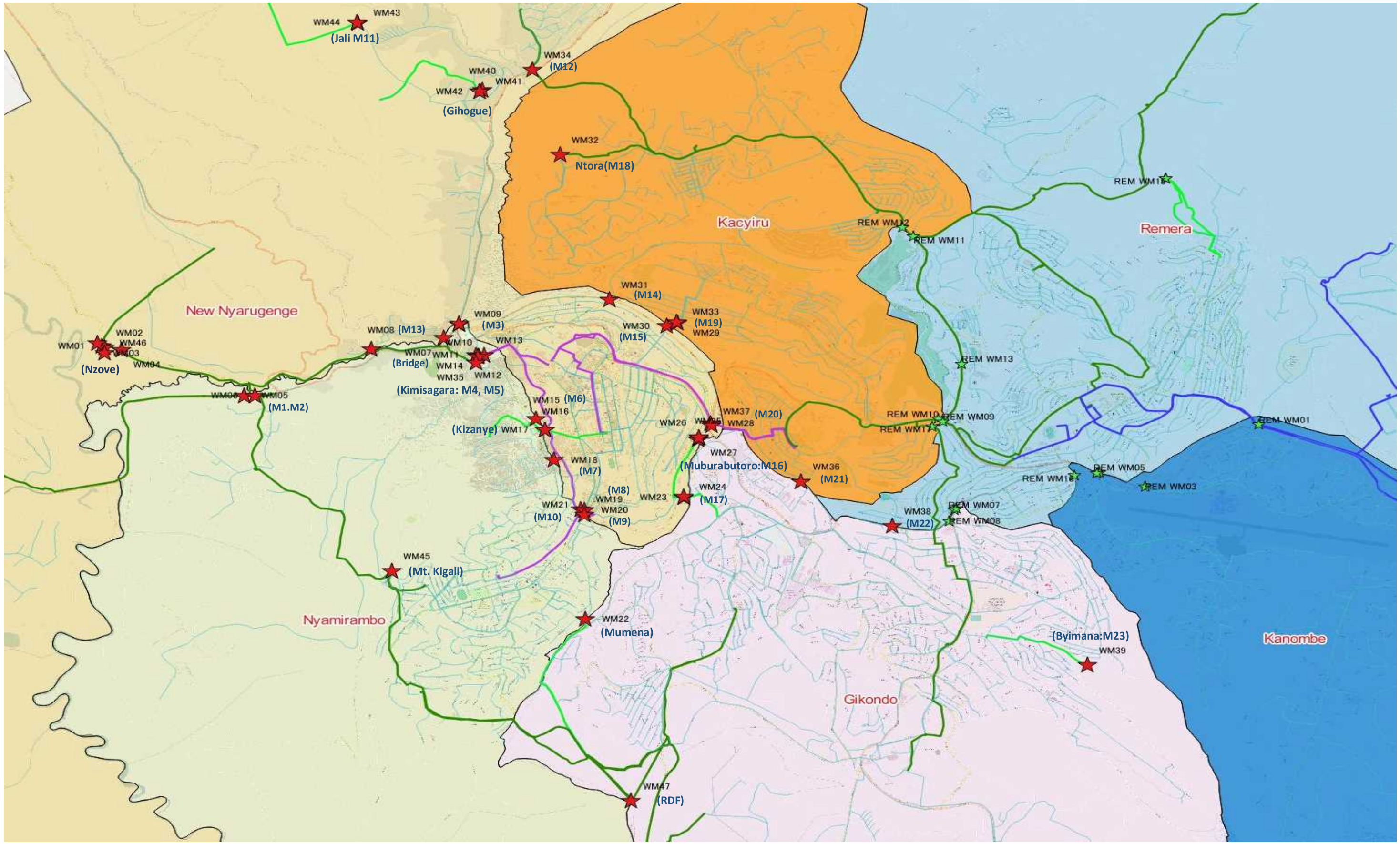
0	1.000
1	0.943
2	0.890
3	0.840
4	0.792
5	0.747
6	0.705
7	0.665
8	0.627
9	0.592



Project Effect 2: Saving of Production Cost by NRW Reduction Activity

Year	Benefit	Cost	Effect of the Action			
			Benefit	Cost	NPV	B/C
1	1,819,066	1,968,920	1,819,066	1,968,920	-149,854	0.9
2	1,716,100	144,000	3,535,165	2,112,920	1,422,245	1.7
3	1,618,962	135,849	5,154,127	2,248,769	2,905,358	2.3
4	1,527,323	128,159	6,681,450	2,376,929	4,304,521	2.8
5	1,440,870	120,905	8,122,320	2,497,834	5,624,486	3.3
6	1,359,312	114,061	9,481,632	2,611,895	6,869,736	3.6
7	1,282,369	107,605	10,764,001	2,719,500	8,044,501	4.0
8	1,209,783	101,514	11,973,784	2,821,015	9,152,769	4.2
9	1,141,304	95,768	13,115,088	2,916,783	10,198,305	4.5
10	1,076,702	90,347	14,191,790	3,007,130	11,184,660	4.7

Attachment 6: Equipment List of the Monitoring System



JICA
SUSWAS
M: Manhole
WM: Water Flow Meter

Project for Strengthening NRW Control in Kigali City Water Network

Procurement Work for the Equipment of the Monitoring System

Inspection Report for Pre Site Acceptance Test on Installation and Performance

Attachement 1: List of the Site

No.	Location	Manhole	Water Flow Meter(FIT, FQS)				PIT: Pressure Meter (bar)	Datalogger
			No.	Type	DN mm	Pulse Reader		
1	Manhole	M1	5	FIT (E＆H W800)	150			
		M2	6	FIT(E＆H W800)	200		40	xx
2	Bridge	-	7	FQS(SENSUS)	40			
3	Manhole	M13	8	FIT(E＆H W800)	80		40	x
4	Manhole	M3	9	FIT(E＆H W800)	150		40	x
5	Manhole	M6	15	FIT(E＆H W800)	80		40	x
6	Manhole	M7	18	FIT(E＆H W800)	100		40	x
7	Manhole	M8	19	FIT(E＆H W800)	200		40	x
8	Manhole	M9	20	FIT(E＆H W800)	50		40	x
9	Manhole	M10	21	FIT(E＆H W800)	100		40	x
10	Manhole	M17	23	FIT(E&H W800)	250		40	xx
			24	FIT(E&H W800)	150		40	
11	Manhole	M20	28	FIT(E&H W800)	200		40	xx
			37	FIT(E&H W800)	200			
12	Manhole	M19	29	FIT(E&H W800)	200		40	xx
			33	FIT(E&H W800)	80		40	
13	Manhole	M15	30	FIT(E＆H W800)	300		40	x
14	Manhole	M14	31	FIT(E＆H W800)	300		40	x
15	Ntora Reservoir	M18	32	FIT: UFM(E&H)	600			x
16	Manhole	M12	34	FIT(E＆H W800)	200		40	x
17	Manhole	M21	36	FIT(E＆H W800)	80		40	x
18	Manhole	M22	38	FIT(E＆H W800)	200		40	x
19	Nzove WTP	Pump House	1	ex.FQS（SENSUS）	150	x	40	
			2	ex.FIT（Krohne）	600		40	
		Pump House	3	ex.FQS（SENSUS）	250	x	40	
			4	ex.FQS（SENSUS）	200			
		Skol	5	ex.FQS(STORONGONE)	150			
		New Pump House	46	FIT（E&H）	600		40	
		Operator Room						xx
20	Kimisagara WTP		10	ex.FQS（SENSUS）	150	x		
		M4	11	FIT(E&H W800)	80			
		WASAC	12	ex.FIT（Krohne）	300			
		M5	13	FIT(E&H W800)	80			x
		WASAC	14	FIT(E&H W400)	400			
		WASAC	35	FIT(E&H W400)	400			
		Pump House					40	
		Operation Room						xx

No.	Location	Manhole	Water Flow Meter(FIT, FQS)				PIT: Pressure Meter (bar)	Datalogger
			No.	Type	DN mm	Pulse Reader		
21	Gihogwe PS	WASAC	40	FIT(E&H W800)	80			
			41	FIT(E&H W800)	80			
		WASAC	42	FIT(E&H W800)	100			
		Pump House					40	xx
22	Jali PS	-	43	FIT(E&H W800)	100			
		M11	44	FIT(E&H W800)	125			
		Pump House					40	x
23	Kizanye PS	-	16	FIT(E&H W800)	80			
		-	17	FIT(E&H W800)	80			
		Pump House					40	x
24	Mburabutoro PS	M16	25	FIT(E&H W800)	100		40	
		Pump House						x
25	Byimana PS	M23	39	FIT(E&H W800)	150		40	
		Pump House						x
26	Mumena PS		22	FIT(E&H W800)	100			
		Pump House					40	x
27	New Mt. Kigali Reservoir	Pump House	45	ex.FIT(E&H)	400			x
28	RDF	-	47	FIT(E&H W800)	150			x
Total		23	46				29	35

Note:
FIT: Flow Indicator Transmitter (Electromagnetic Flow Meter)
UFM: Ultrasonic Flow Meter
FQS: Flow Quantity Sampler (Mechanical Flow Meter)
PIT: Pressure Indicator Transmitter

Attachment 7: Support for Countermeasures Taken Against COVID-19

WASAC
Water & Sanitation Corporation
'Dignifying Life'

Kigali, 11 JUN 2020
No. 11.07.024/1454/2020/CE0-DUWSS/Jb

Mr. MARUO Shin
Chief Representative
JICA Rwanda Office

Dear Sir,

Re: Request for support to WASAC strategic response to COVID-19

In line with national measures to reduce risks of infection and spread of COVID-19, WASAC is doing its best to ensure continuity of water supply and sanitation services to its esteemed customers and stakeholders.

With reference to JICA's cooperation with WASAC and cognizant of JICA's wide experience in dealing with disasters, pandemics included, WASAC wishes to request JICA's support to strategically respond to COVID-19 challenging circumstances.

Further to technical discussions held, and from the long list of strategic responses to COVID-19 for water sector herewith attached, we have identified key priority interventions as follows:

- Support to provide temporary water supply in critical areas by purchasing and installing Plastic Tanks to be regularly filled by water tankers. Given the procurement and logistics procedures involved in purchasing water tankers, they might be locally hired in the midterm.
- Development of Business Continuity Plan to improve WASAC resilience to COVID-19 and other disasters that might impact the company's daily operations including strategies to overcome affiliated risks.
- Procurement of essential supplies such as chemicals like coagulants, chlorine and reagents which are necessary to sustain water supply operations and services.
- Procurement of some maintenance materials (pipe connection, fittings, PRVs, floater valves).
- Financial support to help the company to cover the decrease of revenue during this outbreak.

We take this opportunity to reiterate our appreciation of JICA's usual collaboration and look forward to strengthened cooperation during this special period.

Sincerely,

WATER AND SANITATION CORPORATION WASAC CHIEF EXECUTIVE OFFICER

IN 2020/06/12 JICA Rwanda

Eng. Aime MUZOLA
Chief Executive Officer

Copy to:
- **Hon. Minister of Infrastructure**
- **Permanent Secretary - MININFRA**

KN4 Av8, CENTENARY HOUSE, Nyarugenge District, Kigali City, Rwanda. Tel: + (250) 788181427
E-mail: wasac@wasac.rw, www.wasac.rw

Attachment

Long list for strategic response on COVID-19 for water sector

No	Priority (Request to JICA)	Availability	Type of assistance	Name of Project	Contents
1	X	High	Technical Cooperation	Assistance on establishing Business Continuity Plan (BCP)	Establish Business Continuity Plan (BCP) to continue the essential activities and businesses during the possible future hazardous events, responding to and making most of the COVID-19 experiences for the future.
2		Medium	Grant (Procurement of material)	Implementation of BCP	Provision of necessary equipment to implement BCP
3		Medium	Technical Cooperation	Improvement of public awareness for water supply	Development of public awareness program on TV and radio
4		High	Technical Cooperation	Establishing Guidelines and Training Systems for Water Kiosk Providers	Establishing guidelines for approriate safe handling of water and water container, physical distancing during queing and dealing, and customer Q&A, responding to COVID-19. Customized training (or consultation) and support should be also provided via the phone. This guideline also intends to establish the best practices guide for safe
6	X	Medium	Grant (Procurement of material)	Sanitation commodities for markets, schools etc.	Procure prevention and sanitation commodities such as hand-washing stations, soap, hand sanitizers.
7		Medium	Technical Cooperation	Improvement of Hygiene measures	Guidance on correct hygiene measures
8	X	Medium	Grant (Procurement of material)	Provision of on-site type tap & sink (accompanied with provision of water tanker and/or small tank)	Provision of hygeneical remedial improvement measures especially for people who has limited access for clean water
9	X	Medium	Grant (Procurement of material)	Provision of chemical for water treatment	Provision of flocculant and disinfectant
10	X	Medium	Grant (Procurement of material)	Reduction of intermittent water supply 1	Provision of service pipes, customer meters and other materials
11	X	Medium	Grant (Procurement of material)	Reduction of intermittent water supply 2	Provision of pipe repair materials
12	X	Medium	Grant (Procurement of material)	Reduction of intermittent water supply 3	Provision of PRVs and FVs
13	X	High	Technical Cooperation	Study of Emergency Water Supply	Emergency Water Supply Plan for 1)Exisitng Service: Similar to BCP 2)unserved area/people: Temporary service point and service method such as allocation of water tanker, temporal kiosk/tanks, PR to residents.
14		Medium	Grant (Procurement of material)	Procurement of tele-communication devices and provision of communication expenses.	a. Internet connection (including modems and routers) b. TV conference devices (in UWSSD)
15		Low	Grant (Procurement of material)	Provision of remote working system	Provision of e-approval system and TV conference system to connect all branches
16		Medium	Grant (Procurement of material)	Improvement of water quality supplied	Provision of chlorine injection equipment at reservoir
17	X	Low	Financial Support	Financial support to water utilities to mitigate the impact of decreased revenue	Financial support
18		Low	Technical Cooperation/Grant (Procurement of material)	Water Utility Regional Cooperation against COVID-19 (Procurement)	Establish communication systems among water utilities in the region (African countries).
19	X	Low	Grant	Improvement of water supply to important facilities	Upgrade of pipeline and water tank for hospital and clinic/ Enhancement of distribution facilities
20		Low	Grant	Improvement of meter reading and billing	Provision of customer meter (AMR)
21		Low	Grant	Installation of SCADA for Multiplexed operation	Upgrade of SCADA

WASAC
Water & Sanitation Corporation
"Dignifying Life"

Kigali, 24 JUL 2020
N° 11.07.024/1769/20/DUWSS-CEO/ts

Mr. MARUO Shin
Chief Representative,
JICA-Rwanda Office

Dear Sir,

RE: Transmission of list of available suppliers for chemicals, reagents, plastic water storage tanks and different water materials in Rwanda

Reference is made to the Minutes of Meeting concerning JICA support in response to the COVID-19 emergency here attached.

In this regard, I hereby transmit at your office the list of available suppliers for chemicals, reagents, plastic water storage tanks and different water materials in Rwanda.

For more information, find annexed copies of list of COVID-19 response activities, list of suppliers in Rwanda for chemicals, reagents and water materials and technical specifications for coagulant (Sudfloc 3870) and chemical reagents and water materials.

Yours sincerely,

WATER AND SANITATION CORPORATION WASAC CHIEF EXECUTIVE OFFICER

IN 2020/07/27 JICA Rwanda

Eng. Aimé MUZOLA
Chief Executive Officer /WASAC Ltd

MINUTES OF MEETING

CONCERNING

COVID-19 RESPONSE WITHIN THE FRAMEWORK OF

THE PROJECT FOR WATER SUPPLY MASTER PLAN FOR CITY OF KIGALI
AND
THE PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK

AGREED UPON BETWEEN

WATER AND SANITATION CORPORATION OF THE REPUBLIC OF RWANDA
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Water and Sanitation Corporation (hereinafter referred to as "WASAC"), hereby agree that JICA will provide the following support in response to the COVID-19 emergency at the request of WASAC, as part of the activities of two projects: The Project for Water Supply Master Plan for City of Kigali, and the Project for Strengthening the Non-Revenue Water Control in Kigali City Water Network.

- To provide technical support by Japanese Expert
- To provide equipment and chemicals

The details of the activities are listed in ANNEX 1, available suppliers list provide from WASAC are listed in ANNEX 2 attached herewith.

Both sides agree that WASAC shall report to JICA the results of distribution and utilization record of the equipment and chemicals.

The parties acknowledge and agree that this Minutes of Meeting may be executed by electronic signature, which is considered as an original signature for all purposes and has the same force and effect as an original signature. "Electronic signature" includes faxed versions of an original signature or electronically scanned and transmitted versions (e.g., via pdf) of an original signature.

Annex 1: List of COVID-19 Response Activities
Annex 2: List of available suppliers in Rwanda submitted from WASAC

22/07/2020

Eng. Aimé MUZOLA
Chief Executive Officer,
Water and Sanitation Corporation
The Republic of Rwanda

Mr. MARUO Shin
Chief Representative,
Rwanda Office
Japan International Cooperation Agency

Annex 1: List of COVID-19 Response Activities

No		Item	Quantity required with breakdown	Purpose	Sites to be used	Remarks
1		Assistance on Establishing Business Continuity Plan (BCP)	develop a document with WASAC task force team	Continue water supply service even under COVID-19 emergency	WASAC, especially HQ and Branches in City of Kigali	
2		Subcontract with private water tanker owners	contract with private water tanker owners	Emergency water supply for people who have limited access to clean water	Supply to temporal water tanks installed by item No. 3	for five months (till Dec 2020)
3		Temporal water tanks with its stand	tank (10m³) * 2 sets * 18 sites (quantity will be decided after site survey)	Emergency water supply for people who have limited access to clean water	Limited served area in City of Kigali	Installation and operation shall be done by WASAC
4		Coagulant (Sudfloc 3870)	for 3 months	Treat raw water at a water treatment plant	Nzove Water Treatment Plant, Kigali	
5		Reagent for Chlorine total (DPD)		Test water quality in water treatment plants and distribution networks	Central laboratory of WASAC, laboratories in 18 WTPs and distribution networks operated by WASAC in whole country.	
	5-1	Chlorine total (DPD), Powder pillow 10 ml, Range: 0,01 - 2 mg/l Cl2, kit of 100 tests	30 kit			
	5-2	Chlorine-free (DPD), Powder pillow 10 ml, Range: 0 - 5,00 mg/l Cl2, kit of 100 tests	400 kit			
6		Regent for E. Coli, Total Coliforms, and Fecal coliforms		Test water quality in water treatment plants and distribution networks	Central laboratory of WASAC, laboratories in 18 WTPs and distribution networks operated by WASAC in whole country.	
	6-1	LAURYL SULPHATE AGAR	8 Bottles (500g/bottle)			
	6-2	MAC CONKEY AGAR, 250 gr	5 Bottles (500g/bottle)			
	6-3	Ethanol 95,8 % technical grade for burning, 5L	10 Bottles (5L/bottle)			
	6-4	SPS AGAR, 100 gr	1 Bottle (250g/bottle)			
	6-5	SLANETZ BARTLEY AGAR BASE, 500 gr	1 Bottle (500g/bottle)			
	6-6	Tox trak reagent set: Media set Bacterial count broth tubes, Reaction tubes with cap, Tox trak powder pillow, Tox trak accelerator solution	1 set			
	6-7	Colilert-18 reagent for 100ml sample,	4 Packages (200 tests/package)			
	6-8	Quality Control Coliform and E, Coli Kit	1 Package (3 tests/package)			
	6-9	Quality Control Fecal Coliform Kit	1 Package (3 tests/package)			
	6-10	Quality Control E, Coli Kit	1 Package (9 tests/package)			
7		Material for reduction of intermittent water supply	service pipes, pipe repair materials, floater valves, etc. (items and quantity will be fixed)	Reduction intermittent water supply	service area of WASAC	Installation shall be done by WASAC with necessary support by the NRW project

Annex 2: List of suppliers in Rwanda for Chemical, Reagents and water materials

No	Item	Local supplier Name and Address	Experience	Observation
1	Coagulant for water treatment (Sudfloc 3870)	AFRICA GENERAL TRADING Ltd, PO Box 6/16/2020 6949 Kigali, Tel.0788607609/ 0788610783/0788831914, Email: agt_sarl@yahoo.com	More than 5 Years of supplying (from 2010 up to now)	Exclusive distributor of manufacturing factory
		Top20 LTD PO Box. 1540 Kigali, Tel. 0788306620, Email: top20rwanda@gmail.com	More than 5 Years of supplying	Last supply 2019
		Africhem Rwanda Ltd, B.P 1396 Kigali-Rwanda, tel. +25078830882, +250733308822. Email.: paolo@africhem.com	2016	Contract terminated
		G.S Vision Ltd, PO Box 943 Kigali. Tel. +250788301939/ +250788519741, Email.: g.svision@yahoo.com, KG 2 AV 4, CPR HOUSE KIMIHURURA	From 2017 up to 2018	Contract terminated
2	Chemical reagents for water analysis	Palin Corporation (R) Ltd TIN: 102088135, Tel.: +250788838889, Email.: emmanuel@palineurope.com, KN 8 Ave 64 KACYIRU Sector, Gasabo District.	2016 and 2020	Current frame contract signed
		Africhem Rwanda Ltd, B.P 1396 Kigali-Rwanda, tel. +25078830882, +250733308822. Email.: paolo@africhem.com	2017	Contract terminated
		SCEDULAB Ltd, KN 2 AVENUE 12/P.O Box 1232 Kigali/ Rwanda, Tel. +25078859532, +250788464801. Email.: scedulab.ltd@gmail.com	2019	Contract terminated
3	Service Pipes ,Pipe repair Material	Aquasan Ltd E-mail: info@aquasanrw.com Tel.: 0788380855	More than15 Years of supplying	Experienced in Water Materials manifacturing
		Top20 LTD PO Box. 1540 Kigali, Tel. 0788306620, Email: top20rwanda@gmail.com	More than 5 Years of supplying	Now has the contract for Supplying water materials in Wasac
		Prowater Rwanda Ltd E-mail: prowaterrwanda@yahoo.com Tel.: 0788351338	2016	Now has the contract for Supplying water materials in Wasac
		Roto Rwanda E-mail:gm.rotorwanda@gmail.com Tel.:0788303966/0738303966	From 2017	Around 3 Years in Pipes manifacturing
4	Floater Valve and PRVs	Top20 LTD PO Box. 1540 Kigali, Tel. 0788306620, Email: top20rwanda@gmail.com	More than 5 Years of supplying	Current frame contract signed
		ETS NAFOLD B.P:2961 KIGALI Phone:0788527031 Email:nafold2005@gmail.com	More than 10 Years	Supplied FVs and PRVs for NRW Project in Kigali 2019
5	Water Tanks and stands	Ameki Color Rwanda Contact: 0788385179 / Bp.1162 Remera Free Zone www.amekicolor.com	From 1996	The speciality is Tank made in Fiberglass wich can resist up to 40 years
		Prowater Rwanda Ltd E-mail: prowaterrwanda@yahoo.com Tel.: 0788351338	2016	More than 3 Years and supplied various Institutions
		Roto Rwanda E-mail:gm.rotorwanda@gmail.com Tel.:0788303966/0738303966	More than 20 Years	-Have been in Plastic Water Tank in Rwanda for the past 20 years
6	Private water tanker owners	Kalimu Ally Contact: 0788513192 /Kigali	Number of Tank: 3*16m3	
		KAMANA Olivier Contact: 0788511088 /Kigali	Number of Tank: 3*16m3	
		NDAGIJIMANA Fidelle Contact:0781049909/Kigali	Number of Tank: 2*16m3	

Annex 3: Technical specification for coagulant (Sudfloc 3870), chemical reagents and water tanks

No	Designation	Specification	
1	**Coagulant for water treatment**		
1.1	Sudfloc 3870	**General information**	
		Appearance	Clear to pale yellow Viscous liquid
		Chemical strength	18% - 25%
		SG at 25°C	1.22 - 1.33
		pH (as is)	4.0 max
		Viscosity, Brookfield LV, #2 at 30rpm	<50 cPs
		Iron content	≤0.001 %
		Manganese content	≤0.005 %
		Insoluble matters	≤0.001 %
		Other impurities	< 0.0001 %
		Toxic substances	
		Chromium, Cr as total Cr (Cr^{6+})	≤0.001 %
		Lead, Pb^{2+}	≤0.001 %
		Cadmium, Cd^{2+}	≤0.001 %
		Mercury, Hg^{2+}	≤0.001 %
		Arsenic, As, as total As	≤0.001 %
2	**Chemical reagents for water analysis**	**General information**	
2. 1	Chlorine total (DPD)	Powder pillow 10 ml, Range: 0,01 - 2 mg/l Cl2, kit of 100 tests	
2. 2	Chlorine-free (DPD)	Powder pillow 10 ml, Range: 0 - 5,00 mg/l Cl2, kit of 100 tests	
2. 3	LAURYL SULPHATE AGAR	500g/bottle)	
2. 4	MAC CONKEY AGAR	500g/bottle	
2. 5	Ethanol	95,8 % technical grade for burning, 5L	
2. 6	SPS AGAR	250g/bottle	
2. 7	SLANETZ BARTLEY AGAR BASE	500g/bottle	
2. 8	Tox trak reagent set	Media set Bacterial count broth tubes, Reaction tubes with cap, Tox trak powder pillow, Tox trak accelerator solution	
2. 9	Colilert-18 reagent	For 100ml sample, (200 tests/package)	
2. 10	Quality Control Coliform and E, Coli Kit	3 tests/package	
2. 11	Quality Control Fecal Coliform Kit	3 tests/package	
2. 12	Quality Control E, Coli Kit	9 tests/package	
3	**Water Tank**	**General information**	
		Construction: Fiberglass	
		Dome-top design	
		Brand made in Rwanda	
		Sunlight and impact resistant	
		Capacity of 10.000 ltrs	
		Resistant to Cracking or Denting	
		Easy to Install	
		Ultraviolet radiation resistance	
		Sanded and repainted in case needed	
		Easy reparation and put back into service	
4	**Stand structure (Support)**	Stand Metallic tube: 75*75*15 minimum	
		Reinforcement Met: Tubes: 60*40*15	
		Laying metallic tube:60*40*15	
		Distance between Laying steel: 10	
		Ladder must be included	

Note: The coagulant product is intended to be used for water treatment. Certificates of conformity to international standards (ISO, EN) as good for potable water and technical data sheet are also needed

Technical Note

concerning

Temporal Water Tanks with its Stand and

Subcontract with Water Tanker Owners

24th August 2020

Based on Minute of Meeting which was agreed between JICA and WASAC on 22nd July, 2020 concerning COVID-19 Response within the Framework of the Project for Water Supply Master Plan for City of Kigali and the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network, we hereby agreed upon the following concrete contents of the support.

A. Temporal Water Tanks with its Stand

1. **The setting point of the water tank is 17 sites (Refer to attached table).**
2. **Total number of the tanks to be procured is 25 (Refer to attached table).**
3. **The necessary land for temporal water tanks should be secured by WASAC.**
4. **Specification of the water tank: Capacity 10m3, Fiberglass made**
5. **JICA Rwanda office will procure the water tanks and its stands with ladders, and WASAC will install them on the sites.**
6. **The Project will procure equipment and materials of public taps and WASAC will install public taps at the water tanks.**
7. **The Project will procure the equipment and materials of "water level stand pipe" and "inlet pipe with water meter which is used for injection of water from the water tanker to the water tank", and WASAC will install them.**
8. **JICA Rwanda office and the Project will deliver the above-mentioned equipment and materials to each site (Refer to attached table). However, in case the site is not available when those equipment and materials are ready, they will be delivered to WASAC central store. the equipment and materials will be inspected before the delivery and handed over to WASAC after the delivery.**
9. **Branch Managers (Remera, Kanombe, Kacyiru, Nyarugenge) of WASAC have responsibility to perform proper management (operation and maintenance) of the water**

tanks with public taps at each branch.

10. WASAC will ask local government or landlord to appoint the manager in order to operate the public tap. Tariff should be collected by public tap manager from the customer as 20RWF/20L. Public tap manger will pay to WASAC as 323RWF/m3 and its VAT.

11. WASAC has responsibility to the water quality management of the water tank.

12. Once the necessity of emergency water supply was diminished at one site, WASAC has to relocate the tank to other necessary place or keep it at WASAC central store for the future use, and inform the Project of its act.

B. Subcontract with Water Tanker Owners

1. The transportation of the water to the water tanks will be entrusted to the private owners who have water tankers. The project will make the subcontract with the owners and manage it. The contract period is from completion of setting of water tanks by WASAC until the end of December, 2020 tentatively in accordance with the present Project Period. About the subsequent operation, WASAC will discusses it with the Project some other time.

2. There is no payment between WASAC and the owner of water tanker. The owner does not be involved in buying and selling of the water which is carried by the tanker under this subcontract. Similarly, the project does not concern in buying and selling of the water, too

3. As a basic operation method of the water tanker, water will be delivered once a day on regular basis (not on demand basis) by the tanker in order to avoid the complexity of the operation. However, it shall be re-examined when that method is not realistic to the real situation including the seasonal change at each site.

4. WASAC will make a proper operation plan by collaboration with JICA expert team in consideration of the condition mentioned above, before the contract will be made with the water tanker owner.

5. The water loading point to the water tanker is only the site of Kimisagara water treatment plant. One inlet line inside of the site is available for the work of "Subcontract with Private Water Tanker Owners". The outside lines are not available for this purpose.

Available water loading time is ten hours from 7:00 am to 17:00 pm in a day. WASAC has responsibility to manage the water volume loaded to the water tankers (recording and reporting of water measurement volume).

6. The Project will supply portable pumps and tubes for the water injection from the water tanker to the water tanks. The number of the pumps is 17 for the sites of water tanks. The Project will deliver this equipment to WASAC central store. And the equipment is handed over to WASAC soon after their inspection.

7. WASAC Branch Offices have responsibility to keep and maintain above-mentioned pumps in good condition. And the pumps are used when the water tanker injects the water to water tank by public tap manager or Branch staff. Water volume measurement (recording and reporting) should be performed under management of Branch Office. Branch office will bear the operation cost of the pump including the fuel.

C. Consideration to the Support Activity by JICA

WASAC will consider it that the information of this activity by JICA on emergency water supply for the critical area will be spread over the inhabitants. WASAC will carry out public relations activities on this matter together with JICA.

Mr. Shigeo OTANI
Chief Advisor
JICA Expert Team
Japan

Mr. Méthode RUTAGUNGIRA
Project Director &
Director of UWSS, WASAC
The Republic of Rwanda

Mr. Masanobu MAYUSUMI
JICA Long Term Expert
Japan

Amendment of
Technical Note concerning
Temporal Water Tanks with its Stand and
Subcontract with Water Tanker Owners

6th October 2020

Regarding Technical Note concerning Temporal Water Tanks with its Stand and Subcontract with Water Tanker Owners signed 24th August 2020 based on Minute of Meeting which was agreed between JICA and WASAC on 22nd July, 2020 concerning COVID-19 Response within the Framework of the Project for Water Supply Master Plan for City of Kigali and the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network, we hereby agreed upon the following amendment as follows;

Original

A. Temporal Water Tanks with its Stand

1. The setting point of the water tank is 17 sites (Refer to attached table).

B. Subcontract with Water Tanker Owners

6. The Project will supply portable pumps and tubes for the water injection from the water tanker to the water tanks. The number of the pumps is 17 for the sites of water tanks. The Project will deliver this equipment to WASAC central store. And the equipment is handed over to WASAC soon after their inspection.

Amendment

A. Temporal Water Tanks with its Stand

1. The setting point of the water tank is 23 sites (Refer to attached table).

B. Subcontract with Water Tanker Owners

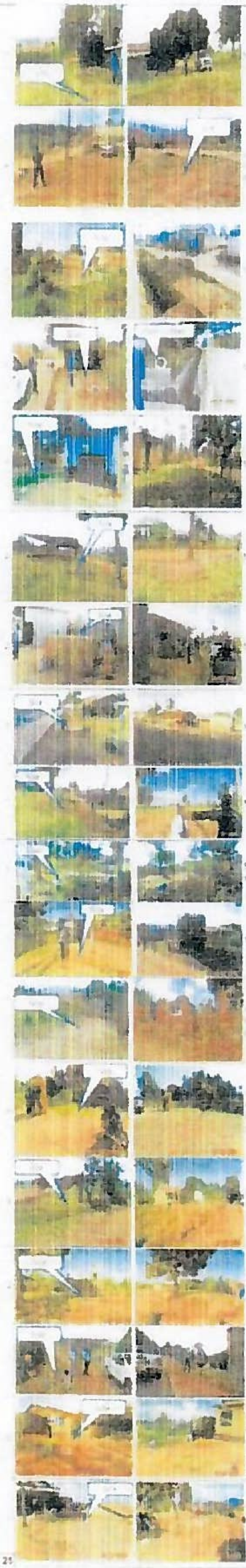
6. The Project will supply portable pumps and tubes for the water injection from the water tanker to the water tanks. The number of the pumps is 23 for the sites of water tanks. The Project will deliver this equipment to WASAC central store. And the equipment is handed over to WASAC soon after their inspection.

Mr. Shigeo OTANI
Chief Advisor
JICA Expert Team
Japan

Mr. Méthode RUTAGUNGIRA
Project Director &
Director of UWSS, WASAC
The Republic of Rwanda

Mr. Masanobu MAYUSUMI
JICA Long Term Expert
Japan

Site List of Temporal Water Tanks (Original)

No.	[illegible]	Branch	Supply days per week / Supply hours per day	Way of Water Supply	Number of Beneficiaries: [illegible]	Number of Beneficiaries: [illegible]	[illegible]	[illegible]	[illegible]	Site Photo	[illegible]	[illegible]
1	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
2	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
4	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
5	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
6	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
7	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
8	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
10	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
11	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
12	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
13	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
15	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
16	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
18	[illegible]		[illegible]	Create the new public tap	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
TOTAL					1,288	13,184	278	38	25			

WASAC [illegible]

2

Site List of Temporal Water Tanks (Amendment)

No.	Site Name	Branch Name	Location (Address)	Coordinates X	Coordinates Y	No of Tank to be Supplied by JICA	No of Tank to be Supplied by WASAC	Site condition	Expected Delivery Date(Availability of the Site)	Note
1	Bibare	Remera	District: Gasabo Sector: Kimironko Cell: Bibare Village: Ingenzi Contact:0788543453	-1.939705	30.13361	0	1	On cell's office	Existing tank is now available on masonery formation ready to receive water	WASAC
2	Zindiro		District: Gasabo Sector: Bumbogo Cell: Kinyoga Village: Zindiro	-1.950142	30.14377	1		Road is somehow complicated	Still one challenge to meet with local authorities and if possible change the location	JICA
3	Kamahinda		District: Gasabo Sector: Kimironko Cell: Kibagabaga Village: Kamahinda	-1.942248	30.128953	1		No problem	This is WASAC space	JICA
4	Musave 1		District: Gasabo Sector: Bumbogo Cell: Musave Village: Rebero	-1.934582	30.175111	1		Near Primary School	Place is available near existing Public tap	JICA
5	Musave 2		District: Gasabo Sector: Bumbogo Cell: Musave Village: Kayumba	-1.934583	30.18765	1		On cell's office	Place is available at cell office.	JICA
6	Avega Village		District: Gasabo Sector: Kimironko Cell: Bibare Village: Imena Contact: 0788501582	-1.944063	30.135656	2		No problem	No problem	JICA
7	Busanza Masaro	Kanombe	District: Kicukiro Sector: Kanombe Cell: Busanza Village: Karama Contact:0788682973	-1.988126	30.150897	1		No problem	The place is flat and owner waiting to do all necessary requirement.	JICA
8	Busanza-Gikondiro		District: Kicukiro Sector: Kanombe Cell: Busanza Village: Gikondiro Contact:0788985181	-1.984012	30.150871	1		No problem	Land need some preparation that will be done by local authorities	JICA
9	Busanza-Gashyushya-Bibare		District: Kicukiro Sector: Kanombe Cell: Busanza Village: Gashyushya Contact: 0783268904	-1.982991	30.145957	1		No problem	No problem	JICA
10	Rwambogo Upper		District: Kicukiro Sector: Nyarugunga Cell: Rwimbogo Village: Rurangendwa	-1.962882	30.137179	0	2	No problem	Two existing reservoirs with 20m3 are well installed and waiting the starting for the operation.	WASAC
11	Gasaraba Downstream		District: Kicukiro Sector: Nyarugunga Cell: Nsoko Village: Gasaraba	-1.963419	30.146181	1		No problem	Place is available	JICA
12	Muyumbu 1		District: Rwamagana Sector: Muyumbu Cell: Akinyambo Village: Kubugugu	-1.958518	30.253301	1		No problem	No Problem	JICA
13	Myumbu 2		District: Rwamagana Sector: Muyumbu Cell: Akinyambo Village: Rugarama Contact: 0784782093	-1.960301	30.246132	0	2	No problem	No problem	WASAC
14	Mvumbu 3		District: Rwamagana Sector: Muyumbu Cell: Nyarukembe Village: Rubona	-1.991006	30.240424	1		Road is somehow complicated but local authorities promoted that the maintenance is on going	Place is available near the existing of Public tap	JICA
15	Masaka-Gitaraga 1	Kanyinya	District: Kicukiro Sector: Masaka Cell:Gitaraga Village: Rwintare Contact: 0786056076	-2.008445	30.179152	1		No problem	Local authorities and landlord approved site, now they will make Land Rent agreement between (WASAC-Landlord)	JICA
16	Masaka-Gitaraga 2		District: Kicukiro Sector: Masaka Cell:Gitaraga Village: Ruhanga Contact: 0782154174	-2.006526	30.181372	1		No problem	Local authorities and landlord approved site, now they will make Land Rent agreement between (WASAC-Landlord)	JICA
17	Ntora 1		District: Gasabo Sector: Gikomi Cell: Ruhango Village: Ntora	-1.912738	30.055247	1		No problem	Site is well leveled	JICA
18	Ntora 2		District: Gasabo Sector: Gikomi Cell: Ruhango Village: Ntora	-1.911514	30.054866	1		No problem	Site is well leveled	JICA
19	Gasanze 1		District: Gasabo Sector: Ndoba Cell: Gasanze Village: Kagarama Contact: 0788470386	-1.888781	30.099347	1		No problem	Wasac Site	JICA
20	Gasanze 2		District: Gasabo Sector: Ndoba Cell: Gasanze Village: Nyakabungo	-1.885274	30.091575	1		No problem	Available space and clean given by Landlord, he accept to sign Land agreement with local authorities	JICA
21	Gasanze 3		District: Gasabo Sector: Ndoba Cell: Gasanze Village: Nyakabungo Contact: 0789199163	-1.884178	30.101053	1		No problem	Site is available choosen and approved by local authorities.	JICA
22	Ndoba		District: Gasabo Sector: Ndoba Cell: Shango Village: Mirambi	-1.878639	30.12957	2		No problem	Site is available near the old masonery reservoir	JICA
23	Muganza National	Nyarugenge	District: Nyarugenge Sector: Kinazagara Cell: Kinazagara Village: Sangwa	-1.949036	30.044416	1		Site is secured	No Problem the site is public and local authorities are ready for everything.	JICA
24	Nyagasozi		Sector: Jabana Cell: Kabuye Village:NYAGASOZI Contact:0788518149	-1.899679	30.056767	1		No problem	Sites are available flat and need only cleaning	JICA
25	Amakiriro		Sector:Jabana Cell: Kabuye Village:Amakiriro Contact: 0782940168	-1.891678	30.051489	1				JICA
26	Rebero		Sector: Jabana Cell: Kabuye Village: Rebero Contact: 0783764172	-1.882807761	30.055196	1				JICA
						24	5			

Technical Note

concerning

Subcontract with Water Tanker Owners

13th October 2020

In terms of Technical Note concerning Temporal Water Tanks with its Stand and Subcontract with Water Tanker Owners signed 24th August 2020 based on Minute of Meeting which was agreed between JICA and WASAC on 22nd July, 2020 concerning COVID-19 Response within the Framework of the Project for Water Supply Master Plan for City of Kigali and the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network, we hereby agreed upon the following operation method for subcontract with owner of water tanker;

Operation Method for Subcontract with Water Tanker

1) Purpose:
   Water transportation of the drinking water to Public Tap for emergency water supply by using water tanker. The Project (Kyowa Engineering Consultant: KEC) will make subcontract with Owner of water tanker for water transportation.

2) Users of water supplied by water tanker
   Twenty-three (23) public taps (PTs) where temporal water tanks were provided by JICA and three (3) PTs where water tanks of WASAC are existing.

3) The supplier of water
   Owner of water tanker

4) Water loading place to water tanker
   The supplier loads water to the water tanker at Kimisagara WTP of WASAC. The volume of water will be measured by the meter at loading place in Kimisagara WTP.

5) Measurement of supply quantity to PT
   The supply quantity to PT will be measured by bulk water meter. If there is no bulk water meter, measurement will be done per water tank full volume.

6) Subcontract base with the supplier:
   Unit transportation cost base contract. The water charge is not included in the cost.

7) Payment by Public Tap Manager (PTM)

The PTM will not pay to the Owner of Tanker.

The PTM will pay his monthly bill to WASAC as per the volume that will be injected in his tank at the price of normal public tap.

8) Payment by supplier (Owner of Tanker)

There is no payment between WASAC and the owner of water tanker. The owner is not involved in buying and selling of the water which is carried by the tanker under the subcontract. Owner of Tanker will not pay to WASAC as for water supply to PTM.

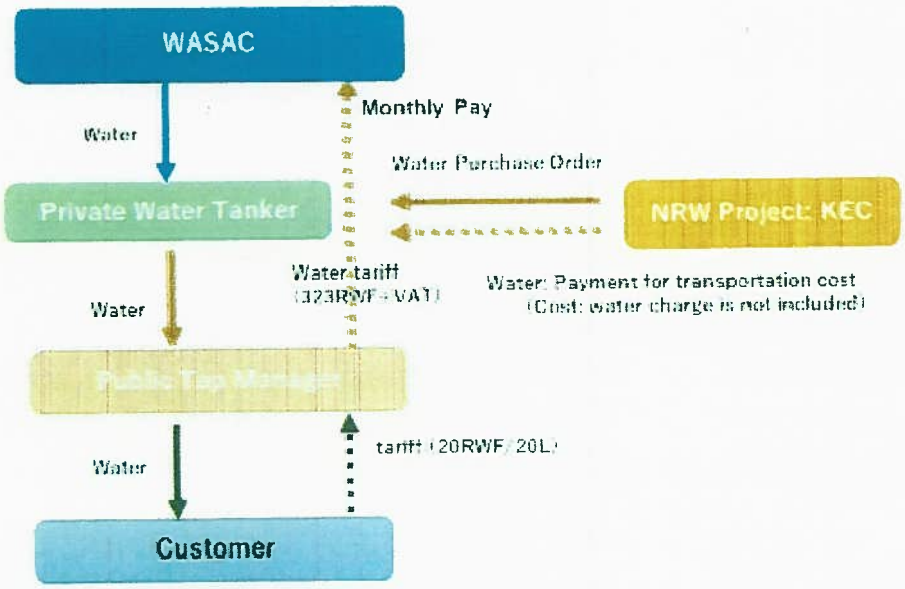
9) Payment by the Project

KEC does not concern in buying and selling of the water. KEC will pay the water transportation cost to the Owner of tanker as subcontract fee. Payment will be made based on the transportation quantity (supplied volume to the water tanks of PTs) and unit cost of transportation.

10) Billing and Payment Method

Monthly base payment at the beginning of the next month

Measure for Water Distribution for Emergency Water Supply



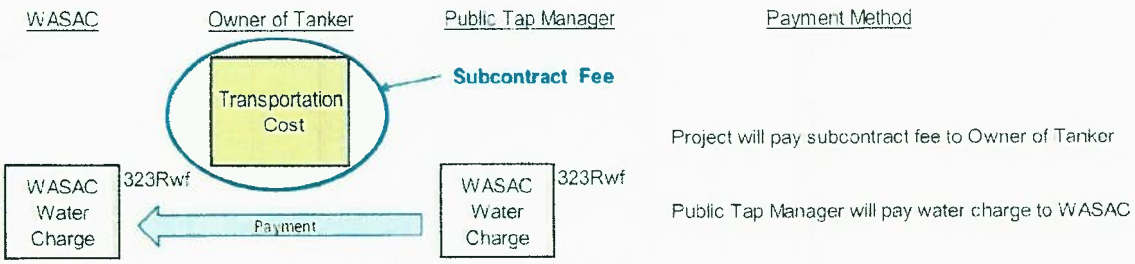


Figure: Payment Method

Mr. Shigeo OTANI
Chief Advisor
JICA Expert Team
Japan

Mr. Méthode RUTAGUNGIRA
Project Director &
Director of UWSS, WASAC
The Republic of Rwanda

Emergency Water Supply for the People who have Limited Access to Clean Water

Oct 2nd, 2020

1

MINUTES OF MEETING

CONCERNING

COVID-19 RESPONSE WITHIN THE FRAMEWORK OF

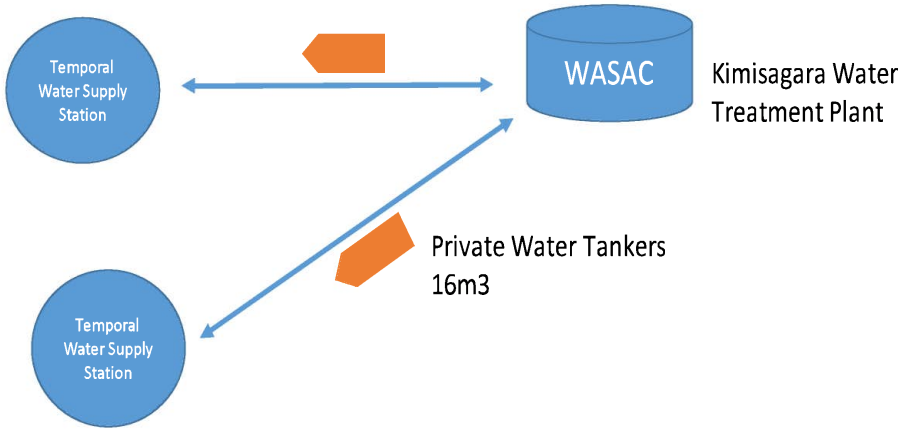
THE PROJECT FOR WATER SUPPLY MASTER PLAN FOR CITY OF KIGALI
AND
THE PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL
IN KIGALI CITY WATER NETWORK

AGREED UPON BETWEEN

WATER AND SANITATION CORPORATION OF
THE REPUBLIC OF RWANDA
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

No		Item	Quantity required with breakdown	Purpose	Sites to be used	Remarks
1		Assistance on Establishing Business Continuity Plan (BCP)	develop a document with WASAC task force team	Continue water supply service even under COVID-19 emergency	WASAC, especially HQ and Branches in City of Kigali	
2		Subcontract with private water tanker owners	contract with private water tanker owners	Emergency water supply for people who have limited access to clean water	Supply to temporal water tanks installed by item No. 3	for five months (till Dec 2020)
3		Temporal water tanks with its stand	tank (10m) * 2 sets * 18 sites (quantity will be decided after site survey)	Emergency water supply for people who have limited access to clean water	Limited served area in City of Kigali	Installation and operation shall be done by WASAC
4		Coagulant (Sudfloc 3870)	for 3 months	Treat raw water at a water treatment plant	Nzove Water Treatment Plant, Kigali	

Emergency Water Supply



10 m3 Tank with Public Taps:

26 sites, 30 Tanks

3

Procurement of the Equipment and Materials by JICA

1. Original July 14, 2020

Tanks/ Sites	Site			Water Tank			Proposal to JICA		
	JICA	WASAC	Total	JICA	WASAC	Total	Piping (Tank)	Meter (Site)	Pump (Site)
18	18	0	18	No decision				18	18
Total	18	0	18				0	18	18

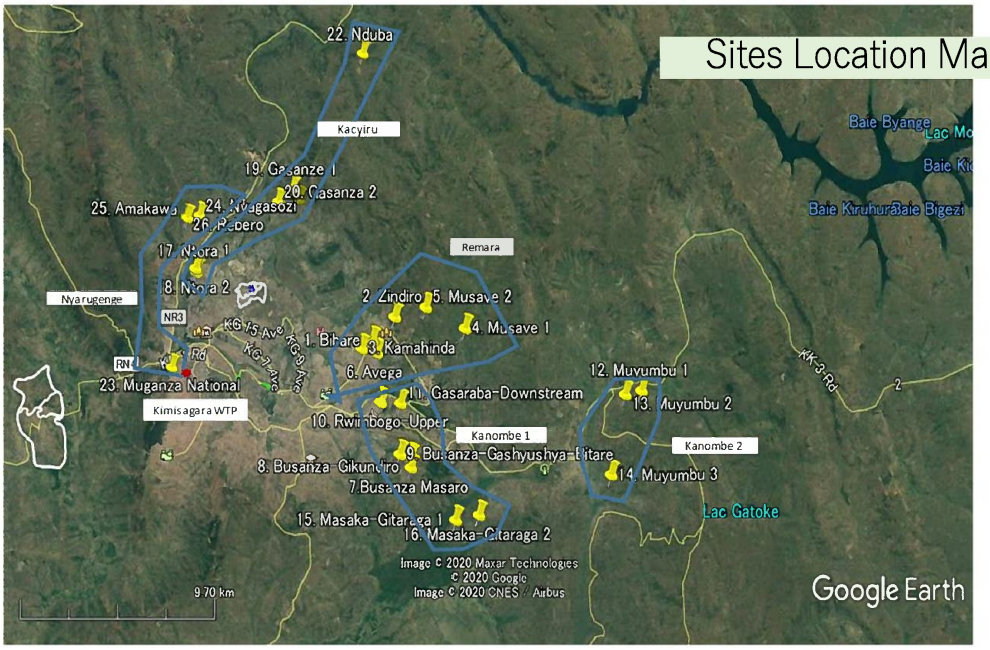
2. Final September 16, 2020

Tanks/ Sites	Water Tank			Water Tank			Proposal to JICA		
	JICA	WASAC	Total	JICA	WASAC	Total	Piping (Tank)	Meter (Site)	Pump (Site)
1	21	1	22	21	1	22	21	21	22
2	2	2	4	4	4	8	4	4	4
Total	23	3	26	25	5	30	25	26	26

As of today JICA approved 18 sets of Meters and Pumps not 26 sets

4

Sites Location Map



5

Operation Plan of Water Tanker

Branch	Site No	Site Name	JICA/ WASAC	Water Tank		Distance from Kimisagara	Water Volume		Required Working Hours		Tanker Number	
				Tank	Total		Dry Season	Rainy Season	Distance	Moving Time	Rainy Season	Dry Season
				nos	nos		m3	m3	km	hour		
Remera	1	Bibre	WASAC	1		Middle	10	5	14	0.7		
	2	Zindiro	JICA	1		Middle	10	5	16	0.8		
	3	Kamahinda	JICA	1	7	Middle	10	5	13	0.7	1	1
	4	Musave 1	JICA	1		Middle	10	5	17	0.9		
	5	Musave 2	JICA	1		Middle	10	5	17	0.9		
	6	Avega	JICA	2		Middle	20	10	15	0.7		
Kanombe 1	7	Busanza Masaro	JICA	1		Middle	10	5	20	1.0		
	8	Busanza Gikundiro	JICA	1		Middle	10	5	20	1.0		
	9	Busanza Gashyushya Bitare	JICA	1		Middle	10	5	20	1.0		
	10	Rwinbogo Upper	WASAC	2	8	Middle	20	10	14	0.7	1	2
	11	Gasaraba Downstream	JICA	1		Middle	10	5	14	0.7		
	15	Masaka Gitaraga 1	JICA	1		Middle	10	5	20	1.0		
	16	Masaka Gitaraga 2	JICA	1		Middle	10	5	20	1.0		
Kanombe 2	12	Muyumbu 1	JICA	1		Far	10	10	37	1.8		
	13	Muyumbu 2	WASAC	2		Far	10	10	37	1.8		
	14	Muyumbu 3	JICA	1	4	Far	10	10	37	1.8	1	2
Kacyiru	17	Ntora 1	JICA	1		Near	10	10	7	0.5		
	18	Ntora 2	JICA	1		Near	10	10	7	0.5		
	19	Gasanze 1	JICA	1	7	Middle	10	10	14	0.7	1	1
	20	Gasanze 2	JICA	1		Middle	10	10	14	0.7		
	21	Gasanze 3	JICA	1		Middle	10	10	14	0.7		
	22	Nduba	JICA	2		Middle	20	20	25	1.2		
Nyarugenge	23	Muganza National	JICA	1		Near	10	10	2	0.2		
	24	Nyagasozi	JICA	1	4	Near	10	10	7	0.5	0.5	1
	25	Amakawa	JICA	1		Near	10	10	7	0.5		
	26	Rebero	JICA	1		Near	10	10	7	0.5		
Total				30	30		290	215			4.5	7
						Far	30	30				
						Middle	200	125				
						Near	60	60				

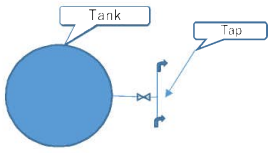
Note
Distance: Between Kimisagara WTP and Site
Moning time: Between Kimisagara WTP and Site
Work time site: Work time at site
Day work time: Required working hours per day in total by 16m3 tanker

6

Operation Plan of Water Tanker

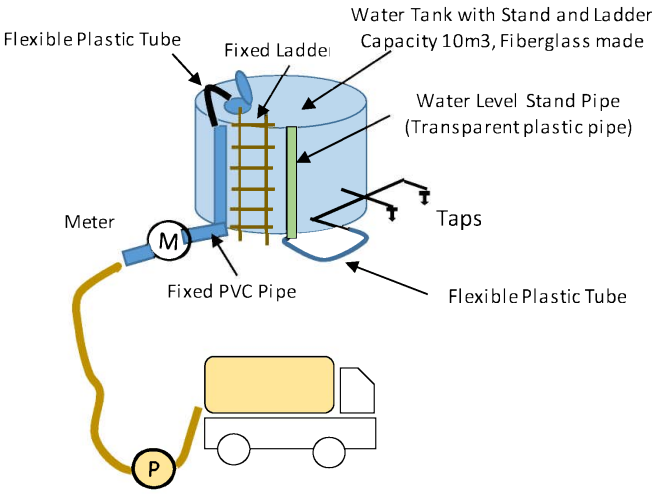
- Operation area of the water tanker shall be divided into 4 areas in accordance with the management area of each Branch office.
- The payload of the water tanker shall be more than 16m3 in consideration of efficiency.
- Before the contract with the owner is made, a draft of operation schedule of water tanker shall be prepared by WASAC and JICA expert.
- However, it shall be re-examined when that method is not realistic to the real situation including the seasonal change at each site.
- Based on present estimation, 5 Tankers for rainy season and 7 Tankers for dry seasons will be requested.
- WASAC has responsibility to the water quality management of the water tank.

7



Existing Water Tank

Proposed Water Tap Facilities



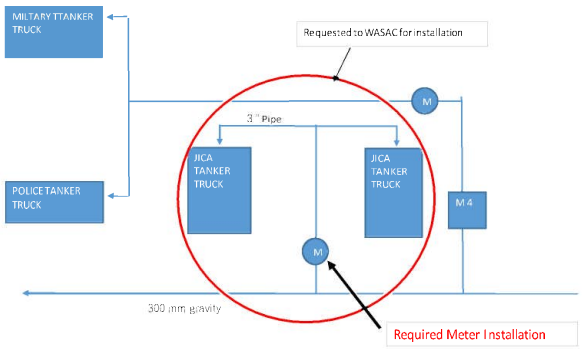
9

Loading Point of Water to the Tanker

1) Kimisagara Water Treatment Plant
2) Is there enough discharge capacity of the line?
4) How the volume of water loaded to the tanker is measured and recorded?
5) Who will manage this work?

10

Water Receiving Place in Kimisagara WTP



11

Work allocation

- JICA office: Procurement of water tanks and its stands : 25sets
- JICA HQ : Procurement of Water Tanker : 1 truck
- Project (Kyowa): Procurement of pipe material to Tanks : 25 sets
  Bulk water meter and Engine pump : 18 sets
- WASAC: Installation of Tanks with Public Taps and Operation
- Project (Kyowa) : Sub-contract for delivery water
  by water tanker to Sites

12

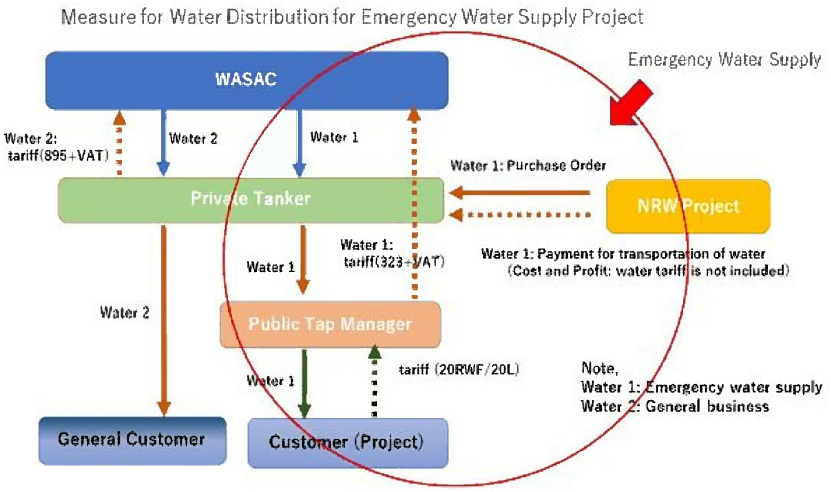
The Party in charge and Work Period

Emergency Water Supply for Disaster COVID-19

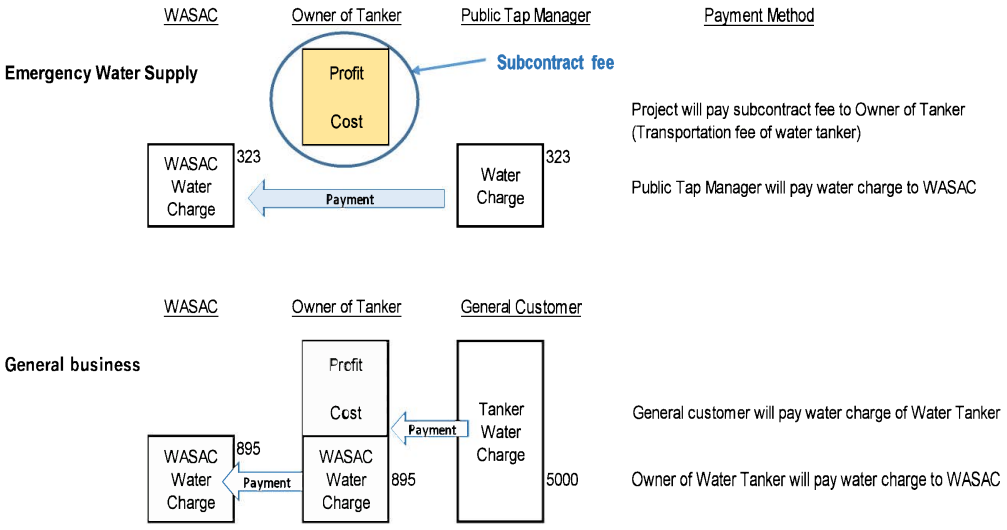
Items	2020						2021					
	July	Aug	Sept	Oct	Nove	Dec	Jan	Feb	Mar.	Apr	May	June
1. Procurement of Tanks by JICA Office	Ameki		◄——►									
2. Procurement of One Water Tanker by JICA		——►										
3. Installation of Temporal Water Tanks with Taps by WASAC				◄——►								
4. Operation of Water Tanker by the Project (1)		Preparation ——►		▽Contract	◄—— Operation ——►							
5. Operation of Water Tanker by the Project (2)						Extension ▽	◄—— Operation ——►					

13

Operation System of the Emergency Water Supply

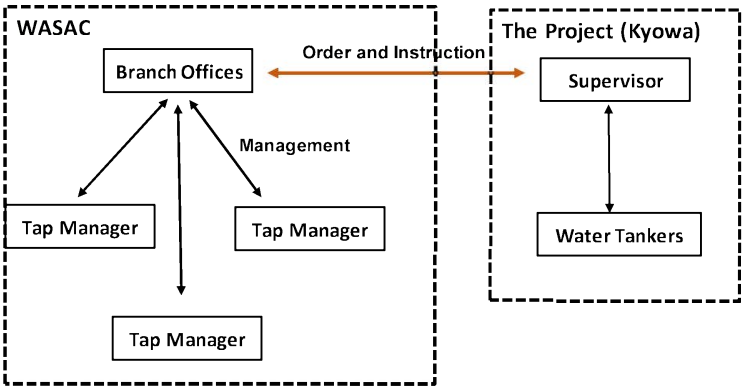


14



15

Purchase Order and Instruction



- Each Branch office shall appoint a person in charge of management of all water tanks in the branch area.
- JICA expert shall appoint a supervisor in charge of the supervisory work of the activity of the owner under the contract.

16

1) Operation of Branch Offices

- Branch Managers (Remera, Kanombe, Kacyiru, Nyarugenge) of WASAC have responsibility to perform proper management (operation and maintenance) of the water tanks with public taps at each branch.
- Branch Offices have responsibility to keep and maintain engine pumps in good condition. The pumps should be keep at PT in safe condition and used when the water tanker injects the water to water tank. Water volume measurement (recording and reporting) should be performed under management of Branch Office. Branch office will bear the operation cost of the pump including the fuel.

17

2) Operation and Payment of Public Tap

- The PTM will pay his monthly bill as per the volume (323RWF/m3) that will be injected in his tank at the price of normal public tap.
- The PTM will not pay to the Owner of Tanker.

18

3) Operation and Payment by Owner of water tanker

- **Water will be delivered once a day by water tanker which will be managed by the Project. (water will be delivered on regular basis)**
- **Owner of Tanker will not pay at Kimisagara/WASAC as for water supply to PTM.**
- **As for the billing for the general customer use, the supplier pays water charge to WASAC based on the tariff rate 895RWF/m3.**
- **Measurement of supply quantity to PT: The supply quantity to PT is measured at PT. During the time before completion of the installation of attachment to the tank, measurement is done by per tank full volume 10m3. After completion, the measurement is done by the bulk water meter.**

19

List of Owners of Tanker

No.	Name	Address	Contact		Owned number of tanker	Capacity
			Tel	E-mail		
1	NYABYENDA J M	KIGALI	0788553849	innocentkzg@gmail.com	2	16m3
2	KAMANA OLIVIER	KIGALI	0788511088	olivier.kamana@yahoo.com	3	16m3
3	KARAMBIZI ADRIEN	KIGALI	0788483545	Not interested ?	3	16m3
		KIGALI			2	6m3
4	KARIM ALLY	KIGALI	0788513192	Not interested ?	3	16m3
5	MURENZI YVES	KIGALI	0788693270	Not interested ?	1	6m3
6	NDAGIJIMANA FIDELE	KIGALI	0781049909	ndafidele02@gmail.com	2	16m3
7	NSHIMIYIMANA ABDALLAH	KIGALI	0788523139	Not interested ?	1	16m3
8	NSHIMYUMUKIZA Pacifique	KIGALI	0788562671	npaco03@yahoo.com	3	16m3
9	HAMADI ALLY	KIGALI	O788531231	hamadially1955@gmail.com	2	16m3

20

4) Operation and Payment by the Project (Kyowa)

- KEC will pay the water transportation costs (expense and profit of Owner of Tanker) to the Owner of tanker in a NRW project budget.

21

Issue on Billing way by WASAC commercial

- WASAC shall issue the bill divide into Water Tap manager and Owner of water tanker.
- Billing volume to Owner of Tanker is the volume subtracted billing of PTM from Kimisagara loading.
- If current payment method by Owner of water tanker is a payment at each time, this must be changed to a monthly base payment.
- Is this way acceptable by commercial department or not ?

22

Thank you

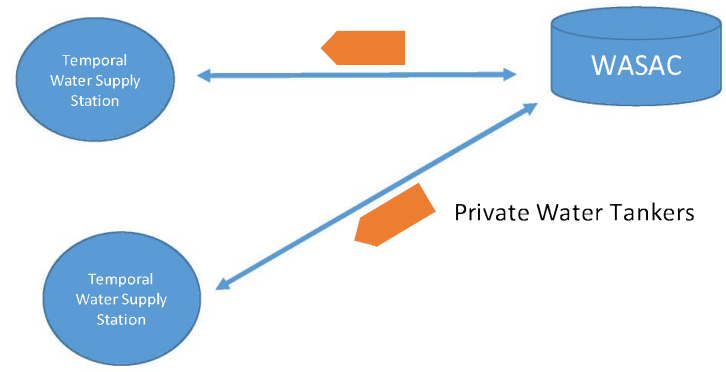
23

Emergency Water Supply for the People who have Limited Access to Clean Water

July 28, 2020

1

Emergency Water Supply



10 m3 Tank with Public Taps:

2

1. Location

- Current water supply situation at each site
- Seasonal situation at each site

2. Number of Tanks

(No. of household, No. of people, Demand, Tank capacity)

Critical Area for Water Supply in Kigali

3

3. Work allocation

- JICA: Procurement of tanks and its stands
- WASAC: Installation of Tanks with Public Taps and Operation
- Project: Delivery of water by water tanker

• [NOTE]

- Tap, pipes and fittings are not included in JICA procurement.
- JICA will procure only tanks and its stands, deliver them to Central store, inspect them and handover them to WASAC.

4

4. Operation of Water Tank

- WASAC will ask local government or landlord to manage the public tap.
- Tariff should be collected by public tap manager from the customer as 20RWF/20L
- Public tap manger will pay to WASAC as 323RWF/m3.
- There is no payment between WTP and water tanker for this purpose.
- Water will be delivered once a day by water tanker which will be managed by the Project. (water will be delivered on regular basis, not on demand basis.)
- Once the necessity of emergency water supply was diminished at one site, WASAC has to relocate the tank to other necessary place or keep it at central store for the future use, and inform the Project of it.

5

5. Water Tank Specification

1) Capacity : 10m3
2) Material : Fiber or Polyethylene
3) Stand for Tank (Steel) with/without ladder

6

6. Public Tap Specification

a. Taps and fittings

b. Ladder for Manhole of Tank

c. Water level stand pipe

(transparent plastic hose 50mm with colored ball)

7

Standing Equipment to the Public Tap

- **The water filled in the tanker should be transferred to fixed tank without NRW.**
- **Who will measure the volume of water poured from water tanker to the water fixed tank?**

CLIENT : KYOWA ENGINEERING CONSULTANTS CO.LTD

No	Item	Specification	Description	Quantity	Unit price	Price	Note
1	Engine pump		Net Weight(kg):65 discharge head-max.(m):45 Capacity-max.(m^3/h):36 Water Inlet Diameter(mm):50 Water Outlet Diameter(mm):50	18	375000	6750000	To supply water from the tank of the water truck to the water tank
2	Water supply hose		Inlet water supply hose : 50mm (Roll of 10 meters) used between the water source and pump	18	120000	2160000	Suction of water to the main supply
			Outlet water supply hose: 50mm of Diameter Length: (Roll of 25 meters) used between pump and water storage	18	85000	1530000	To supply water from the tank of the water truck to the water tank
3	Flow meter		ф50mm water meter (mechanical) Pressure : 16bart, Qn: 15 m3 / hr. Class A	18	200000	3600000	Measure the volume of water supplied from the water truck to the tank
			TOTAL			14,040,000	

Done at Kigali, on 22nd July 2020

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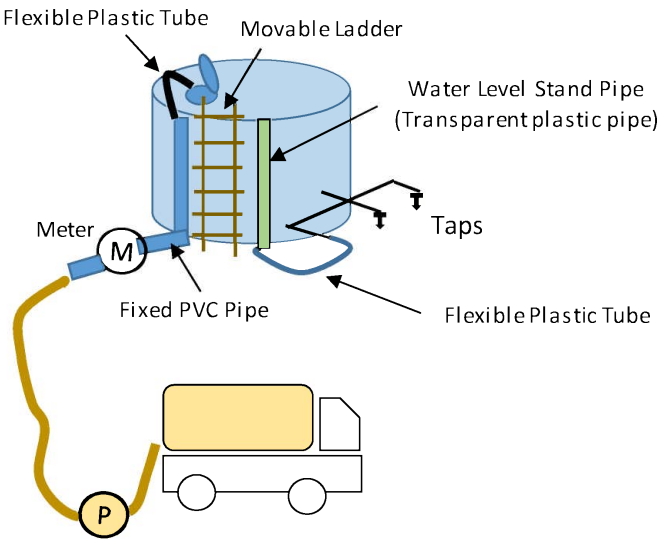

9

7. **Subcontract with private water tanker owners (tentative idea)**

1) Supply Tank Station : 17 place
2) Demand : Gasanze 24m3/day, the others: less than 12 m3/day
3) Loading Capacity of the Tanker : 10m3 to 16 m3
4) Number of water supply per tank per day: 1 time
5) Number of round trips : 3 times per day
6) Required number of the tanker : 6 numbers
7) Exclusive use for WASAC service under the contract
8) Contract period : temporary 6 month (from October)
9) The real operational plan will be updated to the fact while observing the water consumption of inhabitants

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Operation during rainy season (tentative idea)

1) Water tanker takes same moving route as rainy season

6 tankers for three places each

2) If water remain in the tank of the tanker at the end of the day, this water should be returned to the water reservoir in Kimisagara TP, due to hygienic point of view and to prevent NRW. (Is this permissible by WASAC?)

3) Water tanker fills fresh water at Kimisagara every day.

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We need the List of Owners of the Water Tanker

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8. Work Period

Period 1) Procurement of the Water Tanks by JICA Office

Period 2) Installation of the Water Tanks and Public Taps by WASAC

Period 3) Water delivery operation by the Project

Items	2020						2021					
	July	Aug	Sept	Oct	Nove	Dec	Jan	Feb	March	Apr	May	June
1. Subcontract for Private Water Tanker - Procurement of Tanks by JICA Office - Installation with Taps by WASAC -Subcontract with private water tanker by Project	Procurement of Tanks & Installation			Operation & Inspection								

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9. Loading Point of Water to the Tanker

1) Kimisagara Water Treatment Plant
2) Is there enough discharge capacity of the line?
3) Is there other point?
4) How the volume of water loaded to the tanker is measured and recorded?
5) Who will manage this work?

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Thank you

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Attachment 8: Monitoring Sheet

PM Form 3-1　Monitoring Sheet Summary

TO CR of JICA　RWANDA　OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet　: Ver.1（Term: August, 2016 – September, 2016）

Name: Shigeo OTANI
Title: Chief Advisor/ Non-Revenue Management
Submission Date: Sept. 15, 2016

I. Summary

1　Progress

1-1　Progress of Inputs

1-1-1 Japan Side

(1) List and Assignment Terms of Japanese Experts

1) 1st Phase (as of Sept.15, 2016)

a. Working in Rwanda

a. Working in Rwanda

Field in Charge		Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/14	2016/9/15	1.1
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2016/8/14	2016/9/15	1.0
3	NRW Reduction Plan 1（1）	Chiaki SUZUKI	2016/8/15	2016/9/13	1.0
4	NRW Reduction Plan 1（2）	Hiroyasu YODA	2016/9/7	2016/9/15	0.3
5	NRW Reduction Plan 2（1）	Toru TOYODA	2016/8/15	2016/9/15	1.1
6	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI			
7	GIS	Eita HORISHITA	2016/8/14	2016/9/15	1.1
8	Hydraulic Analysis	Hiroki OE	2016/8/15	2016/9/15	1.1
9	Leak Detection	Junichi TAKAHASHI			
10	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO			
11	Pipe Repairing and Service Connection（2）	Hiroshi TAKASHIMA			
12	ICT	Marcel Brouwer			
Total M/M					6.7

b. Working in Japan

No.	Field in Charge	Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/5	2016/8/12	0.25
10	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO			
Total M/M					0.25

(2) Training

1) Tanning in Japan

Not yet conducted.

2) Training in the 3rd country

Not yet conducted.

(3) List of Equipment Provided for the Project

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Schedule	Actual
Lot 1	Output 2 Training for pipe repairing and service	Materials and equipments for training for pipe repairing and service connection	set	1	Jan., 2017	in Process
Lot 2	Output 3 Pilot Project (2 sets)	Customer mater φ15mm	sets	400	Jan., 2017	in Process
Lot 3	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Jan., 2016	in Process
Lot 4	Output 4: Isolation of 4 Branch	Electric magnetic flow meter, Mechanical flow meter, Pressure	sets	32	June, 2017	in Process
Lot 5	Vehicles for JICA use	Onebox and Pickup	Units	2	Jan., 2017	in Process

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity	Schedule	Actual
Lot 6	Output 2: Leak detection equipment（for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	Sets	3	Feb., 2017	in Process
Lot 7	Survey Equipment for Output 2and 3	Potable GPS	sets	5	Oct., 2016	in Process
		Potable Test Meter	sets	2	Oct., 2016	in Process
		Residual Chlorine Test Meter, Potable Electric conductivity Meter	sets	2	Oct., 2016	in Process

1-1-2 Rwanda Side

(1) Counterpart

List and Assignment Terms of Japanese Experts

No	Field in Charge	Name	Duration	
			From	To
1	CEO of WASAC	James Sano	Aug. 2016	Present
2	Director of UWSS	Methode Rutagungira	Aug. 2016	Present
3	Director of UWSS	Mr. Methode Rutagungira	Aug. 2016	Present
4	Director of CS	Lucien Ruterana	Aug. 2016	Present
5	Director of CFO: Mr. Joseph Ruhinyura	Joseph Ruhinyura	Aug. 2016	Present
6	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
7	Manager of Water Operation Services, UWSS	Innocent Gashugi	Aug. 2016	Present
8	Manager of Utility Planning Services, UWSS	Dominic Murekezi	Aug. 2016	Present
9	Manager of Revenue Management Services, CS	Désiré Kayiru	Aug. 2016	Present
10	Manager of Customer Service Management, CS	Felix Gatanazi	Aug. 2016	Present
11	Head of leak detection and pressure management, NRW, UWSS	Désiré Ntamuturano	Aug. 2016	Present
12	Kachiru Branch Manager	Musabyeyez Jeanne	Aug. 2016	Present
13	Gikondo Branch Manager	Mutamba Jane	Aug. 2016	Present
14	Nyarugenge Branch Manager	Byamugisha Bernard	Aug. 2016	Present
15	Nyamirambo Branch Manager	Saranda Catherine	Aug. 2016	Present
16	Kanonbe Branch Manager	Aimable Ndagijimana	Aug. 2016	Present
17	Remera Branch Manager	Gilbert Mulindabigwi	Aug. 2016	Present
18	Head of zoning and mapping services, NRW, UWSS	Jean Paul Kayitare	Aug. 2016	Present
19	Head of water distribution services, NRW, UWSS	Jean Claude Manirakiza	Aug. 2016	Present
20	Leak detection and pressure management Officer	Celestin Mwambutsa	Aug. 2016	Present
21	Fraud Investigation Officer	Viateur Munyanshongore	Aug. 2016	Present
22	Mapping Officer	Claudien Mazimpaka	Aug. 2016	Present
23	Water Distribution Officer of each Branch		Aug. 2016	Present
24	Customer Service Officer of each Branch		Aug. 2016	Present
25	Billing Officer of each Branch		Aug. 2016	Present

(2) Facilities

- Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections

- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection (40 ㎡)
- Store house for equipment

(3) Local Cost

- Cost for administering the Project (utilities for experts offices, internet services)
- Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project

Start-up Meeting of the Project was held Aug. 16 at Galaxy Hotel in Kigali with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Introduction of JICA experts and Counterparts (C/P)
- Explanation and discussion of draft of Work Plan (WP)
- Confirmation of understanding of the project contents (Implementation Schedule).
- Condition for selection of Pilot project area
- Selection of the members of Action teams and other related teams
- Notes for safety measures
- Agenda and facilitator of the Seminar (Kick-Off Meeting) of August 18th.

(2) Kick-Off Meeting of the Project

Kick-Off Meeting was held on Aug. 18, 2016 at Galaxy Hotel in Kigli to show the contents of the project to person concerned including all Branch managers of WASAC, MININFRA. The main topics of the meeting ware as follows:

- Explanation of Project Objectives

- Project implementation Structure
- Project Implementation Flowchart
- Introduction of NRW reduction of Yokohama City
- Discussion

1-2-1: Activities of Output 1: Planning capacity of NRW reduction of WASAC is enhanced.

1.1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.

・The member of the management team is appointed formally in August by CEO.

1.2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.

・Questionnaire survey has conducted for 20 Branch Offices in September.
・Sit visit survey for three Branch Offices, Ruwamagana, Nagatare and Ngoma, was conducted.

1-2-2: Activities of Output 2: Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2.1 Training materials on NRW control are prepared.

2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.

・At the stage when analysis of 1.2 was finished, it will be carried out.

2.3 OJT is conducted on the updating of GIS data, using available GIS data base.

Following works were conducted.
・The technical supplement training that GIS data update of C/P requires
・Rearranging and reexamination of a workflow affecting GIS customer, pipe network data update
・OJT which depends on WASAC Branch boundary line data update
・Activity that GIS data management

2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

・Preparation work

1-2-3: Activities of Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

3.1 An action team is organized to conduct NRW reduction measures at Pilot Area 1.

・The member of the action team is appointed formally in August by CEO, and formation is finished.

3.2 The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer dada, surveys, and other necessary means.

Following works were conducted.

・Selection of two pilot areas from the proposed candidate sites.

・Information dada collection of Kigali city and the two pilot areas.

・Preparation of facilities plan for the establishment of pilot area such as design of the inlet chamber.

1-2-4: Activities of Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.

4.1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

・ About 4 branch isolation, the GIS team and the Branch Offices made opinion adjustment, site investigation in order to decide the boundary lines.

1-3 Achievement of Output

N/A

1-4 Achievement of the Project Purpose

N/A

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by Rwanda side

N/A

1-8 Progress of Environmental and Social Considerations (if applicable)

N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

N/A

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

N/A

2　Delay of Work Schedule and/or Problems (if any)

N/A

2-1 Detail

N/A

2-2 Cause

N/A

2-3 Action to be taken

N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)

N/A

3 Modification of the Project Implementation Plan

3-1 PO

N/A

3-2 Other modifications on detailed implementation plan

N/A

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

Preparation of Rwanda Side toward after completion　of the Project

II. Project Monitoring Sheet I & II　*as Attached*

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network ***Version 1***

Implementing Agency: WASAC ***Dated Sept.,15,2016***

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2019/6/30

Project Site: 4 Branches in Kigali city(Kacyiru, Nyamirambo, Gikondo, I **Model Site:**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city(year 2022 xx %)(to be confirmed during the project)	Annual report of WASAC		N/A	
Project Purpose					
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The Government policy on NRW remains as highly prioritized.	N/A	
Outputs					
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project	The non-revenue water section at WASAC is not subject to large scale reorganization. ・WASAC staff do not resign after training by the project.	N/A	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than XX number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		N/A	
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.) 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		N/A	
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodiclly monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		N/A	

Activities		Inputs				Pre-Conditions
		The Japanese Side		**The Rwanda Side**		
1-1	A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.					
1-2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies	1	Experts Dispatch	1	Counterpart	・Large scale natural disaster does not occur. GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.
1-3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.		Chief Adviser／Non-Revenue Water management		Project Director	
1-4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.		Non-Revenue Water reduction planning		Project Manager	
1-5	Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.		GIS		Management team members	
1-6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.		Hydraulic analysis		Action team members	
1-7	The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.		Leak detection		Other counterparts	
1-8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.		Pipe repairing and service pipe connection			
1-9	The management team prepares the 5-year Strategic Acton Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.		ICT			
1-10	The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.					
1-11	The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2	Training	2	Facilities	**<Issues and countermesures>**
1-12	Seminars are organized to present all the achievements of the project for WASAC and other cconcerned parties.		Training in Japan		Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-1	Training materials on NRW control are prepared.		Training in the 3rd country		Training room with the capacity of about 20 persons	
2-2	Training on NRW management is conducted for the management team and WASAC management as necessary.				Space for training on pipe repair and service pipe connection（40㎡）	
2-3	OJT is conducted on the updating of GIS data, using available GIS data base.	3	Equipment provision		Store house for equipment	
2-4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.		Leak detection equipment			
2-5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.		Ultrasonic flow meter with data logger	3	Local cost	N/A
2-6	In-room training and OJT on reparing leaking pipies and installing service connection for the pilot project are conducted.		Gate valve, flow meter, and customer meter for Pilot Project		Cost for administering the Project (utilities for experts offices, internet services)	
2-7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.		Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali		Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project	
2-8	Training materials on NRW are reviewed and updated.		Equipment for training on pipe repair and service pipe connection		Cost for operation and maintenance of project equipment	
2-9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.		Mobile GPS		Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1	An action team is organized to conduct NRW reduction measures at Pilot Area 1.		Vehicles for Japanese experts			
3-2	The action team grasps the current situations of Pilot Area 1 through reviewing available maps, cusomer ledgers, surveys, and other necessary means.					
3-3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1.					

3-4	The action team hydraulically isolates Pilot Area 1, and installs flow meters and preassure gauges at the inlets of the Pilot Area 1.			
3-5	The action team establishes the baseline NRW rate of Pilot Area 1.			
3-6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8	The action team conducts measures for reducing surface leakage (visible leakage).			
3-9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10	The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12	The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.			
3-13	The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.			
3-15	Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.			
3-16	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
4-1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.			
4-4	System input to each of 4 branches is measured.			
4-5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.			

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 1
Dated Sept.,15,2016

Project Title:Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs	Plan/Actual	1st Year I (8 9 10 11 12)	1st Year II (1 2 3)	1st Year III (4 5 6)	1st Year IV (7 8 9)	2nd Year I (10 11 12)	2nd Year II (1 2 3)	2nd Year III (4 5 6)	2nd Year IV (7 8 9)	3rd Year I (10 11 12)	3rd Year II (1 2 3)	3rd Year III (4 5 6)	3rd Year IV (7 8 9)	Remarks	Monitoring: Issue	Monitoring: Solution
Expert																
Chief Adviser/Non-Revenue Water Management	Plan	■	■	■	■	■		■		■		■	■		N/A	N/A
	Actual	■														
Adviser/Non-Revenue Water Management	Plan	■		■	■				■				■		N/A	N/A
	Actual	■														
NRW Reduction Plan 1(1)	Plan	■	■		■	■		■		■		■			N/A	N/A
	Actual	■														
NRW Reduction Plan 1(2)	Plan		■	■			■		■		■				N/A	N/A
	Actual		■													
NRW Reduction Plan 2(1)	Plan	■		■											N/A	N/A
	Actual	■														
NRW Reduction Plan 2(2)	Plan		■		■										N/A	N/A
	Actual															
Geographic Information System: GIS	Plan	■	■												N/A	N/A
	Actual	■														
Hydraulic Analysis	Plan	■	■												N/A	N/A
	Actual	■														
Leak Detection	Plan			■	■			■	■						N/A	N/A
	Actual															
Pipe Repairing and Service Connection(1)	Plan				■			■	■						N/A	N/A
	Actual															
Pipe Repairing and Service Connection(2)	Plan			■	■										N/A	N/A
	Actual															
Information and Communication Technology: ICT	Plan		■	■	■										N/A	N/A
	Actual															
Equipment																
Lot 1: Equipment for training on pipe repair and service pipe connection	Plan	■	■												N/A	N/A
	Actual															
Lot 2: Pilot Projects (Customer Meter)	Plan	■	■	■	■										N/A	N/A
	Actual															
Lot 3: Pilot Projects (Gate valve, flow meter, and customer meter)	Plan	■	■												N/A	N/A
	Actual															
Lot 4: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)	Plan	■	■												N/A	N/A
	Actual															
Lot 5: Vehicles for Japanese experts	Plan	■	■												N/A	N/A
	Actual	■														
Lot 6: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc)	Plan	■	■												N/A	N/A
	Actual	■														
Lot 7: Mobile GPS, Potable Test meter etc	Plan	■	■												N/A	N/A
	Actual	■														
Training in Japan																
23 persons will be trained in Japan (5, 9, 9)	Plan			■		■	■								N/A	N/A
	Actual															
In-country/Third country Training																
	Plan															
	Actual															

Activities / Sub-Activities	Plan/Actual	1st Year I (8 9 10 11 12)	1st Year II (1 2 3)	1st Year III (4 5 6)	1st Year IV (7 8 9)	2nd Year I (10 11 12)	2nd Year II (1 2 3)	2nd Year III (4 5 6)	2nd Year IV (7 8 9)	3rd Year I (10 11 12)	3rd Year II (1 2 3)	3rd Year III (4 5 6)	3rd Year IV (7 8 9)	Responsible Organization: Japan	Responsible Organization: RWANDA	Achievements	Issue & Countermeasures
Output 1: Planning capacity of NRW reduction of WASAC is enhanced.																	
1.1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.	Plan	■												Expert	WASAC	Member of the Team are appointed.	N/A
	Actual	■															
1.2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.	Plan	■	■											Expert	WASAC	in progress	N/A
	Actual	■	■	■	■												
1.3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan		■	■										Expert	WASAC	N/A	N/A
	Actual			■	■												
1.4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan		■	■										Expert	WASAC	N/A	N/A
	Actual			■	■												
1.5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.	Plan			■										Expert	WASAC	N/A	N/A
	Actual				■												
1.6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan			■										Expert	WASAC	N/A	N/A
	Actual				■												
1.7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.	Plan			■										Expert	WASAC	N/A	N/A
	Actual					■											
1.8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan				■									Expert	WASAC	N/A	N/A
	Actual					■											
1.9 The management team prepares the 5-year Strategic Acton Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan				■									Expert	WASAC	N/A	N/A
	Actual					■											
1.10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan				■									Expert	WASAC	N/A	N/A
	Actual					■											
1.11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan							■				■		Expert	WASAC	N/A	N/A
	Actual																
1.12 Seminars are organized to present all the achievements of the project for WASAC and other cconcerned parties.	Plan											■		Expert	WASAC	N/A	N/A
	Actual																
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.																	
2.1 Training materials on NRW control are prepared.	Plan	■	■											Expert	WASAC	in progress	N/A
	Actual	■															
2.2 Training on NRW management is conducted for the management team and WASAC	Plan		■											Expert	WASAC	N/A	N/A
	Actual																
2.3 OJT is conducted on the updating of GIS data, using available GIS data base.	Plan		■	■										Expert	WASAC	in progress	N/A
	Actual		■														
2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan		■	■										Expert	WASAC	in progress	N/A
	Actual		■														
2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan				■	■			■	■				Expert	WASAC	N/A	N/A
	Actual																
2.6 In-room training and OJT on reparing leaking pipies and installing service connection for the pilot project are conducted.	Plan				■	■			■	■				Expert	WASAC	N/A	N/A
	Actual																
2.7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan				■	■			■	■				Expert	WASAC	N/A	N/A
	Actual																
2.8 Training materials on NRW are reviewed and updated.	Plan											■		Expert	WASAC	N/A	N/A
	Actual																
2.9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan								■	■				Expert	WASAC	N/A	N/A
	Actual																
Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.																	
3.1 An action team is organized to conduct NRW reduction measures at Pilot Area 1.	Plan	■												Expert	WASAC	Member of the Team are appointed.	N/A
	Actual	■															
3.2 The action team grasps the current situations of Pilot Area 1 through reviewing available maps, cusomer ledgers, surveys, and other necessary means.	Plan		■											Expert	WASAC	in progress	N/A
	Actual		■														
3.3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1.	Plan			■										Expert	WASAC	N/A	N/A
	Actual																
3.4 The action team hydraulically isolates Pilot Area 1, and installs flow meters and preassure gauges at the inlets of the Pilot Area 1.	Plan			■	■	■	■	■	■	■	■			Expert	WASAC	in progress	N/A
	Actual		■														

3.5	The action team establishes the baseline NRW rate of Pilot Area 1.	Plan / Actual	Expert WASAC	N/A	N/A
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Plan / Actual	Expert WASAC	N/A	N/A
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	Expert WASAC	N/A	N/A
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan / Actual	Expert WASAC	N/A	N/A
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual	Expert WASAC	N/A	N/A
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan / Actual	Expert WASAC	N/A	N/A
3.11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual	Expert WASAC	N/A	N/A
3.12	The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.	Plan / Actual	Expert WASAC	N/A	N/A
3.13	The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.	Plan / Actual	Expert WASAC	N/A	N/A
3.14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.	Plan / Actual	Expert WASAC	N/A	N/A
3.15	Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.	Plan / Actual	Expert WASAC	N/A	N/A
3.16	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.	Plan / Actual	Expert WASAC	N/A	N/A
Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.					
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan / Actual	Expert WASAC	in progress	N/A
4.2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan / Actual	Expert WASAC	N/A	N/A
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.	Plan / Actual	Expert WASAC	N/A	N/A
4.4	System input to each of 4 branches is measured.	Plan / Actual	Expert WASAC	N/A	N/A
4.5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.	Plan / Actual	Expert WASAC	N/A	N/A
Duration / Phasing		Plan / Actual			

Monitoring Plan		1st Year				2nd Year				3rd Year				Remarks	Issue	Solution
		I	II	III	IV	I	II	III	IV	I	II	III	IV			
Monitoring		8 9 10 11 12	1 2 3	4 5 6		7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6			
Steering Committee (SC)	Plan / Actual													Project Kik-off meeting was held on Aug. 18, 2016.	N/A	N/A
Set-up the Detailed Plan of Operation (Work Plan: WP)	Plan / Actual													Work Plan was submitted to WSAC on Aug. 18, 2016.	N/A	N/A
Submission of Monitoring Sheet	Plan / Actual														N/A	N/A
Monitoring Mission from Japan	Plan / Actual														N/A	N/A
Joint Monitoring	Plan / Actual														N/A	N/A
Post Monitoring	Plan / Actual															
Reports/Documents																
Inception Report	Plan / Actual															
Progress Report	Plan / Actual														N/A	N/A
Project Completion Report	Plan / Actual														N/A	N/A
Public Relations																
Seminars and Workshops	Plan / Actual														N/A	N/A

PM Form 3-1　Monitoring Sheet Summary

TO CR of JICA　RWANDA　OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet　: Ver.2（Term: 16 August, 2016 – 15 April, 2017）

Name: Shigeo OTANI
Title: Chief Advisor/ Non-Revenue Management
Submission Date: 3 March 14, 2017

I. Summary

1　Progress

1-1　Progress of Inputs

1-1-1　Japan Side

(1)　List and Assignment Terms of Japanese Experts

1)　1st　Phase (as of Feb.28, 2017)

a.　Working in Rwanda

Field in Charge		Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/14	2016/12/11	4.0
			2017/1/15	2016/2/28	1.5
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2016/8/14	2016/9/27	1.5
			2017/1/17	2017/2/28	1.5
3	NRW Reduction Plan 1（1）	Chiaki SUZUKI	2016/8/15	2016/9/13	1.0
			2016/11/10	2016/12/27	1.6
4	NRW Reduction Plan 1（2）	Hiroyasu YODA	2016/9/7	2016/11/14	2.3
			2017/1/17	2017/2/28	1.5
5	NRW Reduction Plan 2（1）	Toru TOYODA	2016/8/15	2016/9/28	1.5
			2017/1/17	2017/2/28	1.5
6	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2016/9/18	2016/12/16	3.0
7	GIS	Eita HORISHITA	2016/8/14	2016/11/11	3.0
8	Hydraulic Analysis	Hiroki OE	2016/8/15	2016/11/12	3.0
9	Leak Detection	Junichi TAKAHASHI			
10	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO			
11	Pipe Repairing and Service Connection（2）	Hiroshi TAKASHIMA	2017/1/17	2017/2/28	1.5
12	ICT	Marcel Brouwer	2016/9/30	2016/12/10	2.4
			2017/2/13	2017/2/13	0.0
Total M/M					30.8

b. Working in Japan

No.	Field in Charge	Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/5	2016/8/12	0.25
10	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2016/12/5	2016/12/16	0.50
Total M/M					0.75

Details of each expert's assignment are shown in the Plan of Operation.

(2) Training

1) Tanning in Japan

The following member participated in the training in Japan between January 1, 2016 and February 2, 2017.

Member of 1st Training in Japan

	Names	Position
1	RUTAGUMGIRA Methode	Director , Urban Water and Sewerage Services (Project Director)
2	BAHIGE Jean Berchmans	Manager, Non-Revenue Water (Project Manager)
3	GATANAZI Felix	Manager, Customer services
4	BYAMUGISHA Bernard	Head of Branch /Nyarugenge
5	MUTAMBA Jane	Head of Branch /Gikondo

Schedule of 1st Training in Japan

No	Day		Travel	Type	Contents	Organizer
1	2017/1/21	Sat	Kigali→			
2	2017/1/22	Sun	Yokohama		Arrival	
3	2017/1/23	Mon	Yokohama	Lecture	Training briefing Programmee Orientation Distribution management system Courtesy call to the Yokohama City Water Works Bureau	JICA Yokohama Yokohama City Water Works Bureau
4	2017/1/24	Tue	Yokohama	Lecture	Block system of Yokohama City Customer Meter Management	Yokohama City Water Works Bureau
5	2017/1/25	Wed	Yokohama	Practical training, Visit	Mapping system Visit a Water Service Memorial Visit at Water Treatment Plant (Nishiya)	Yokohama City Water Works Bureau WTP of Yokohama City
6	2017/1/26	Thu	Yokohama	Lecture Practical training	Quality control and inspection system of service connection Leakage Detection Survey	Yokohama City Water Works Bureau WTP of Yokohama City
7	2017/1/27	Fri	Yokohama		Discussion, Training Evaluation Closing meeting	JICA Yokohama
8	2017/1/28	Sat	Yokohama→ Kyoto			
9	2017/1/29	Sun	Kyoto→Kobe			
10	2017/1/30	Mon	Kobe	Lecture, Visit	Courtesy call to the Kobe City Water Works Bureau History of the City Water Works Visit to facilities	Kobe City Water Works Bureau
11	2017/1/31	Tue	Kobe	Lecture, Visit	NRW Reduction Measure Pressure Management Water Demand Projection Visit to facilities	Kobe City Water Works Bureau
12	2017/2/1	Wed	Kobe→ Yokohama		Discussion, Training Evaluation Closing meeting	JICA Kansai
13	2017/2/2	Wed	Tokyo→Kigali		Departure	

2) Training in the 3rd country

Not yet conducted

(3) List of Equipment Provided for the Project

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Schedule	Actual
Lot 1	Output 2 Training for pipe repairing and service connection	Materials and equipments for training for pipe repairing and service connection	set	1	Mar., 2017	in Process
Lot 2	Output 3 Pilot Project (2 sets)	Customer mater φ15mm	sets	400	Feb., 2017	completed
Lot 3	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Mar., 2016	in Process
Lot 4	Output 4: Isolation of 4 Branch	Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.	set	1	June, 2017	in Process
Lot 5	Vehicles for JICA use	Onebox and Pickup	Units	2	Jan., 2017	completed

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity	Schedule	Actual
Lot 6	Output 2: Leak detection equipment（for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	Sets	3	July., 2017	in Process
Lot 7	Survey Equipment for Output 2and 3	Potable GPS	sets	5	Oct., 2016	Completed
		Potable Test Meter	sets	2	Oct., 2016	Completed
		Residual Chlorine Test Meter, Potable Electric conductivity Meter	sets	2	Oct., 2016	Completed

1-1-2 Rwanda Side

(1) Counterpart

List and Assignment Terms of Counterparts

No	Field in Charge	Name	Duration	
			From	To
Steering Committee (SC)				
1	Chairman: CEO of WASAC	James Sano	Aug. 2016	Present
2	Project Director: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
3	Project Manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
4	Management Team		Aug. 2016	Present
5	Officials from MINIFRA		Aug. 2016	Present
Project Director and Manager				
1	Project Director: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
2	Project manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
Management Team (7 persons)				
1	Leader: Director of UWSS	Mr. Methode Rutagungira	Aug. 2016	Present
2	Co-leader: Director of CS	Lucien Ruterana	Aug. 2016	Present
3	Co-leader: Director of CFO	Joseph Ruhinyura	Aug. 2016	Present
4	Manager of Water Operation Services, UWSS	Innocent Gashugi	Aug. 2016	Present
5	Manager of Utility Planning Services, UWSS	Dominic Murekezi	Aug. 2016	Present
6	Manager of Revenue Management Services, CS	Désiré Kayiru	Aug. 2016	Present
7	Manager of Customer Service Management, CS	Felix Gatanazi	Aug. 2016	Present
Action Team (31 persons)				
1	Leader: Head of leak detection and pressure	Désiré Ntamuturano	Aug. 2016	Present
2	Co-Leader: Kachiru Branch Manager	Musabyeyez Jeanne	Aug. 2016	Present
3	Co-Leader: Gikondo Branch Manager	Mutamba Jane	Aug. 2016	Present
4	Co-Leader: Nyarugenge Branch Manager	Byamugisha Bernard	Aug. 2016	Present
5	Co-Leader: Nyamirambo Branch Manager	Saranda Catherine	Aug. 2016	Present
6	Co-Leader: Kanonbe Branch Manager	Aimable Ndagijimana	Aug. 2016	Present
7	Co-Leader: Remera Branch Manager	Gilbert Mulindabigwi	Aug. 2016	Present
8	Head of zoning and mapping services, NRW, UWSS	Jean Paul Kayitare	Aug. 2016	Present
9	Head of water distribution services, NRW, UWSS	Jean Claude Manirakiza	Aug. 2016	Present
10	Leak detection and pressure management Officer	Celestin Mwambutsa	Aug. 2016	Present
11	Fraud Investigation Officer	Viateur Munyanshongore	Aug. 2016	Present
12	Mapping Officer	Claudien Mazimpaka	Aug. 2016	Present
13	Head of meter management services	Felecien Niringiyimana	Oct. 2016	Present
14	Water Distribution Officer of each Branch		Aug. 2016	Present
15	Customer Service Officer of each Branch		Aug. 2016	Present
16	Billing Officer of each Branch		Aug. 2016	Present

(2) Facilities

Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections

- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection (40 ㎡)

- Store house for equipment

(3) Local Cost

- Cost for administering the Project (utilities for experts offices, internet services)
- Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project

Start-up Meeting of the Project was held Aug. 16 at Galaxy Hotel in Kigali with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Introduction of JICA experts and Counterparts (C/P)
- Explanation and discussion of draft of Work Plan (WP)
- Confirmation of understanding of the project contents (Implementation Schedule).
- Condition for selection of pilot project area
- Selection of the members of Action teams and other related teams
- Notes for safety measures
- Agenda and facilitator of the Seminar (Kick-Off Meeting) of August 18th.

(2) Kick-Off Meeting of the Project

Kick-Off Meeting was held on Aug. 18, 2016 at Galaxy Hotel in Kigli to show the contents of the project to person concerned including all Branch managers of WASAC, MININFRA. The main topics of the meeting ware as follows:

- Explanation of Project Objectives
- Project implementation Structure
- Project Implementation Flowchart
- Introduction of NRW reduction of Yokohama City
- Discussion

(3) Revision of IC/R

The draft of IC/R was presented by JICA Expert Team at Start-up Meeting of the Project, and Kick-Off Meeting of the Project. It was revised on Sept. 15, 2016 as Ver.1 according to progress of the

meantime.

【Output 1】

1-2-1: Activities of Output 1: Planning capacity of NRW reduction of WASAC is enhanced.

1.1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.

The member of the management team is appointed formally in August by CEO, and formation is finished.

1.2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.

- Questionnaire survey has conducted for 20 Branch Offices in September and the answers to the questionnaire are summarized in October. The result was explained for NRW team and discussed it on November 8 .
- Sit visit survey for three Branch Offices, Ruwamagana, Nagatare and Ngoma, was conducted in September to confirm existing activities of WASAC branch offices, the situations of facilities, and evaluate it.
- The site visit survey for remaining 11 Branch offices was started in the middle of February, 2017 and it is going to carry out until the beginning of March.

1.3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

- Information data of GIS and customer (January 2016- July 2016）were analyzed in October and presented the result for future examination of WASAC.
- Among the matters of the high evaluation that became clear from these findings, the matter which should cover for a Five-years NRW reduction strategic action plan were chosen.
- As high measures of the priorities, Preparation of a conceptual long term develop plan of water supply system, Update all customer data, Update and validate GIS pipe network drawings, Replace/repair malfunctioning customer meters/public standpipes, Carry out priority analysis for pipe rehabilitation, Continue rehabilitation of old pipes based on priority analyses were list upped.
- Development policy of the Five-year plan and table of contents were presented.
- The NRW reduction activities are still being proposed.

1.4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

- To make clear the contents and the bill of quantity of the priority of countermeasure, an inventory survey will be carried out. Concrete content of the survey was decided in January, 2017 and assumed an investigation was planned to start from February.

- Specification for inventory survey about facilities was prepared. As a result of the discussion on these contents (general schematic drawing of water reservoir tank, fact-finding of the stand pipe, sampling survey of customer meters) with WASAC in February, WASAC decided to implement by himself.

1-5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.

→ Not yet conducted.

1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

→ Not yet conducted.

1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.

→ Scheduled in March 2017

1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.

→ Scheduled in April 2017

1-9 The management team prepares the 5-year Strategic Acton Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.

→ Scheduled in April 2017

1-10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.

→ Scheduled in May 2017

1-11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

→ Scheduled in April 2018 and in 2nd Phase

1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

→ Scheduled in 2nd Phase

【Output 2】

1-2-2: Activities of Output 2: Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2.1 Training materials on NRW control are prepared.

- In reference to past experience project and "The Manager's Non-Revenue Water Handbook for Africa (Guide to Understanding Water Losses) USAID, World Bank, March 2010", "Non-Revenue Water Management (Consulting Developing Countries), Shozo Yamazaki, March 2011", "Factor on NRW and Concept of NRW Reduction (draft manual)" was prepared and submitted to Project Manager of WASAC and NRW team.

2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.

- The training materials for problem presentation on basic measures of NRW management were made, and a seminar was carried out for four times at every week in a project management meeting in October.
- The training was carried out based on "materials for problem presentation on basic measures of N RW management" mentioned above on November 1.

2.3　OJT is conducted on the updating of GIS data, using available GIS data base.

Following works were conducted.

- The technical training on GIS data update of C/P
- Rearranging and reexamination of a workflow affecting GIS update of customer and pipe network data update
- OJT on update of Branch boundary line data
- Activity that GIS data management
- The introduction of the Google Earth applied for GIS
- Introduction of the software of QGIS to 6 Kigali city branches and Google Earth (input to a PC) was performed to make the environment that WASAC can be shared the GIS data not only HQ but also branch offices and could watch freely, and to have operation and utilization of the GIS software fit the staffs other than the GIS team, and to smoothen a shift to future ArkGIS use.
- The reconfirmation of technology transfer contents and the introduction of the ArcGIS Geometric Network analysis (one of the pipe network analysis functions on ArcGIS) was carried out.

Construction and editing of the pipe network model and analysis by this function can be carried out.

- The Manuals（GIS Procedure Guide and GIS Operation Manual: Data update on management for water network and customer information）were distributed to rerated section of HQ and 6 branch offices.

2.4　OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

Collection of hydraulic analysis-related data, and, the lectures and a seminar of the hydraulic analysis and water pressure management analysis were performed six times for November 8 from September 29 for a GIS team.

- The training of general theory of the hydraulic analysis
- The practice by application EPANET of the hydraulic analysis
- Construction of the use environment of hydraulic analysis software MikeUrban and the training about the usage of it
- Hydraulic analysis of the pilot area

2-5　In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

→ Scheduled from March 2017 and in 2nd Phase

2-6　In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

- A procurement list of the equipment and materials on repairing leaking pipes and installing service connection was prepared.
- Contents of procurement equipment were confirmed and specification and BoQ were decided.
- The procurement preparations such as marketing researches, contract documents, supplier list for competition of quotation were performed.
- Notice for competition of quotation was made October 14 and as a result of evaluation of the documents submitted, the contract with a procurement supplier on November 8. The delivery of the equipment is scheduled in March.
- Fact-finding about activities of each branche including laying and repair of the distribution and service connection pipes was started in January 2017. Extraction of the problems with C/P based on these findings and will make the teaching materials for the training in future.

- Training is in preparation, Scheduled from March 2017 and after July 2017

2-7 In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

→ in preparation, Scheduled from March 2017 and in 2nd Phase

2-8 Training materials on NRW are reviewed and updated.

→ Scheduled in 2nd Phase

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

→ Scheduled in 2nd Phase

【Output 3】

1-2-3: Activities of Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

3.1 An action team is organized to conduct NRW reduction measures at Pilot Area 1.

- The member of the action team is appointed formally in August by CEO, and formation is finished in August 2016.

3.2 The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.

- Selection of two pilot areas (Area 1: Kadobogo (Kiyovu) Kacyiru Branch Area 2: Ruyenzi (Runda) Nyarugenge Branch) from the proposed candidate sites in September 2016.
- Information dada collection of Kigali city and the two pilot areas in September 2016
- Information data update of pilot areas such as population and number of customers

3.3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1.

- A work plan of pilot project for area1 and area2 was prepared.
- Preparation of facilities plan for the establishment of pilot area such as location of inlet chamber and design them including requires equipment such as flowmeter, pressure gauge and valves in September

- The detailed design of the chamber at the inlet (flowmeter setting position) was made in September, and traial excavation was conducted for confirm the number of the existing pipe, laying position, depth, type, diameter, and performed final decision of the structure in October.
- The contents, specification and quantity of the equipment to be installed in the chamber were clarified in October.

3.4 The action team hydraulically isolates Pilot Area 1, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1.

Procurement of Equipments

- Contents of procurement equipment (flowmeter, pressure gauge, valve, customer meter etc.) were confirmed and specification and BoQ were decided in October.
- The procurement preparations such as marketing researches, contract documents, supplier list for competition of quotation were performed in September..
- Notice for competition of quotation was made October 14, and as a result of evaluation of the documents submitted, the contract with a procurement supplier on November 8. The delivery of the equipment is scheduled in March.

Construction of Chambers

- Design of four chambers to be installed inlets of the pilot area was performed for the price competition in September.
- Notice of the price competition to the contractors was made on December 8, 2016 for submission of the quotation on January 27, 2017.　As the result of evaluation of it, contract was agreed on February 15, 2017.
- Construction work will be started from March 1, 2017.

The additional investigation for separation of the tertiary pipe in the Kadobogo pilot area was performed. Isolation work was performed by WASAC.

3-5　The action team establishes the baseline NRW rate of Pilot Area 1.

→ Scheduled in 2nd Phase

3-6　The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.

→ Scheduled in 2nd Phase

3-7　The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.

→ Scheduled in 2nd Phase

3-8 The action team conducts measures for reducing surface leakage (visible leakage).

→ Scheduled in 2nd Phase

3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

→ Scheduled in 2nd Phase

3-10 The action team conducts measures for reducing underground leakage (invisible leakage).

→ Scheduled in 2nd Phase

3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

→ Scheduled in 2nd Phase

3-12 The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.

→ Scheduled in 2nd Phase

3-13 The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.

→ Scheduled in 2nd Phase

3-14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.

→ Scheduled in 2nd Phase

3-15 Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.

→ Scheduled in 2nd Phase

3-16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

→ Scheduled in 2nd Phase

【Output 4】

1-2-4: Activities of Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.

4.1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

- About 4 branch isolation, the GIS team and the Branch Offices made opinion adjustment with advice of JICA expert, site investigation in order to decide the boundary lines in October.
- Because it was revealed that the movement between branches of the customer registration was necessary about the decision of the boundary line, it was decided to adjust it after boundary line decision.
- Four branch separation boundary lines were established by the end of September, 2016, But it was non-start about movement of customer resistration.
- A GIS team clarified re-enrollment about the movement of customer resistration (1712 as of September 2016)

4.2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

- Flowmeter setting positions for isolation of 4 branches were examined on the GIS map jointly with NRW team and GIS team in a project progress meeting of October 7.
- After the position decision on the quantity, individual spot investigation was carried out by JICA team and WASAC team to confirm condition of existing distribution pipes. Trial excavation was conducted for 18 places.
- The joint meeting of the NRW and GIS team was held in order to settle site setting position of flowmeter on October 31.
- The technical specifications of the equipments such as electromagnetic flowmeter, mechanical flowmeter, pressure gauge, valves, data loggers and server hardware etc. for the establishment of monitoring system was prepared by the end of November.
- Technical specification and Bill of Quantity for the tender were submitted to the JICA office on December 9.

4.3 Electromagnetic flowmeters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.

Construction of Chambers

- 23 chambers to be installed in the network were designed for the tender in November.

- Notice of the price competition to the contractors was made on December 8, 2016 for submission of the tender on January 27, 2017. As the result of evaluation of it, contract was agreed on February 15, 2017.

4-4　System input to each of 4 branches is measured.

→ Scheduled in 2nd Phase

4-5　Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.

→ Scheduled in 2nd Phase

1-3 Achievement of Output

Achievement status of the Project outputs is observed according to the PDM indicators as the table below indicates:

Table: Achievement of Outputs

Outputs	Objectively Verifiable Indicators	Status of the Achievement
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	・The relevant information are being collected from existing data and documents.(GIS data, Customer data, PIP: Performance Improvement Programme, NRW Action Plan, Questionaire survey for 20 Branches） ・Site visit survey for up-countries Branch offices) was conducted to get fact-findings of WASAC's NRW reduction activity for the cause analysis of NRW. ・Inventry survey is being conducted by WASAC ・Since not enough time was secured to make action plans in the 1st Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in Phase 2 together with WASAC management team and action team.
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than XX number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	・Training on NRW management was conducted ・OJT was conducted on the updating of GIS data base ・OJT was conducted on hydraulic analysis, and pressure management ・In-room training and OJT on leak detection will be conducted from March 2016 and in the 2nd Phase ・In-room training and OJT on repairing leaking pipes and installing service connection will be conducted from March 2016 and in the 2nd Phase. Procurement of the materials and equipmnets to be used for the training are beeing procured. ・Implementation of the OJT activity is planned in the 2nd Phase. ・Implementation of the activity mentioned in indicators is planned in upcoming steps during the 2nd Phase.
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.) 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	・Two pilot areas (Area 1: Kadobogo,Kacyiru Branch, Area 2: Ruyenzi, Nyarugenge Branch) were selected. ・The preparation work in order to setting up DMA is beeing conducted such as procurement of the equipments and construction of chambers, separation of tertiary distribution pipes and installation of valves in the network.. ・Implementation of the OJT activity is planned in the 2nd Phase.
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodiclly monitored and reported in PIP (Performance Improvement Plan) every month.	・Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was desided. ・Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey. ・Detailed design was done for preparation of technical specifications of the equipment of a monitoring system. Procurement work has not yet started. ・The chambers were designed and consuruction work is started from March 2017. ・The procurement schedule of the equipments is not clear. It is supposed to be the equipment will arrive in July.

1-4 Achievement of the Project Purpose

It is somewhat premature to assess the achievement of the Project's purpose because only a half year has passed since Project started.

1-5 Changes of Risks and Actions for Mitigation

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

(1) Pre-Conditions

Table: Action for Mitigation on Pre-Condition

PDM Pre-Conditions	Curent Situation	Action for Mitigation
1 GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.	1-1 By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017. Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule. In the beginning of September, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikUrban was made by Esri in the end of October.	

(2) Important Assumption on Proceeding Assumptions (from Outputs to Project Purpose)

Table: Action for Mitigation on Important Assumption (from Outputs to Project Purpose)

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The non-revenue water section at WASAC is not subject to large scale reorganization.	1-1 Not applicable	
2 WASAC staff do not resign after training by the Project.	1-2 Not applicable	
3 Large scale natural disaster dose not occur.	1-3 Not applicable	

(3) Important Assumption on Proceeding Assumptions to Overall Goal

Table: Action for Mitigation on Importance Assumptions (from Project Purpose to Overall Goal)

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The Government policy on NRW remains as highly prioritized.	1-1 Not applicable	

1-6 Progress of Actions undertaken by JICA

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs.
- Procurement of leak detection equipment is in process. These are procured until July 2017.
- Procurement of electromagnetic flow meter and pressure gauge and gate valve for isolation 4 branches in Kigali is in process.

1-7 Progress of Actions undertaken by Rwanda side

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Survey and adjustment to decide to points to be construct the chambers.
- Training in Japan
- Concept Note preparation for decision of branch boundary.
- Inventory survey is caring out by WASAC team.
- DMA formation of Pilot Areas (installation of valves, adjustment of tertiary pipe)
- Joint visit JICA-WASAC of WASAC's upcountry branches.

1-8 Progress of Environmental and Social Considerations (if applicable)

No remarkable progress and consideration have been seen.

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

No remarkable progress and consideration have been seen.

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

SUSWAS Project

2　Delay of Work Schedule and/or Problems (if any)

2-1 Detail

1）Delay of preparation of 5-year Strategic Action Plan for NRW reduction (Output 1)

Since not enough time was secured to make action plans in the 1st Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in Phase 2 together with WASAC management team and action team.

It needs to be elaborate on to produce a more tangible and practical institutional framework. The role and responsibilities of the management team in the framework for the NRW reduction plan should be confirmed.

2）Procurement and installation schedule of the equipment of monitoring system (Output 4)

The construction of the chambers to install equipments of monitoring system has already begun, but the procurement schedule of the equipments is not clear.

2-2 Cause

1）Delay of preparation of 5-year Strategic Action Plan for NRW reduction (Output 1)

Because it is a proposition to complete the construction of two places of pilot areas that is work of Output 3 and to complete a flow measurement system to isolate 4 branches for calculate an individual NRW rate that is work of Output 4 by June, 2017, the work of site survey, details design and the preparation of tenders on procurement of equipment and the chamber construction were conducted with precedence. As a result it works of Output 1 is late.

The predicted number of the setting point for electromagnetic flowmeters was increased, because that it was necessary to include not only the boundary but also the WTP, and the needed time for an investigation.

The distribution pipe position was going to be provided by GIS data, but software of Esri was unfinished, and reliable information was not provided. The trial excavation reached for confirmation of existing pipe position. Time for the review of the branch border and for decide the exact position of electromagnetic flowmeters.

2）Procurement and installation schedule of the equipment of monitoring system (Output 4)

The plan of the JICA office is not yet seen.

2-3　Action to be taken

A management team meeting will be held in the middle of March to make an orientation.

2-4　Roles of Responsible Persons/Organization (JICA, WASAC, etc.)

3　Modification of the Project Implementation Plan

3-1 PO

As a major modification, the timeline of Activity 1.7-1.10 will be shifted to the beginning of the 2nd phase from the 1st phase. This modification was reflected as PO ver.1 which will be approved by the SC on April 3, 2016.

3-2 Other modifications on detailed implementation plan

No major modification was made.

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4. Preparation of Rwanda Side toward after completion of the Project

Not applicable.

II. Project Monitoring Sheet I & II

As attached.

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 2

Implementing Agency: WASAC

Dated March 13, 2017

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2019/6/30

Project Site: 4 Branches in Kigali city(Kacyiru, Nyamirambo, Gikondo, Nyaru Model Site:

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city（year 2022 xx %)(to be confirmed during the project)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	N/A	
Project Purpose					
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The non-revenue water section at WASAC is not subject to large scale reorganization. WASAC staff do not resign after training by the Project. Large scale natural disaster dose not occur.	It is somewhat premature to assess the achievement of the Project's purpose because only a half year has passed since Project started.	
Outputs					
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Proiect. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project		・The relevant information are being collected from existing data and documents.(GIS data, Customer data, PIP: Performance Improvement Programme, NRW Action Plan, Questionaire survey for 20 Branches） ・Site visit survey for up-countries Branch offices) was conducted to get fact-findings of WASAC's NRW reduction activity for the cause analysis of NRW. ・Inventry survey is being conducted by WASAC	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than XX number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		・Training on NRW management was conducted ・OJT was conducted on the updating of GIS data base ・OJT was conducted on hydraulic analysis, and pressure management ・In-room training and OJT on leak detection will be conducted from March 2016 and in the 2nd Phase ・In-room training and OJT on repairing leaking pipes and installing service connection will be conducted from March 2016 and in the 2nd Phase. Procurement of the materials and equipmnets to be used for the training are beeing procured. ・Implementation of the OJT activity is planned in the 2nd Phase.	
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.) 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		・Two pilot areas (Area 1: Kadobogo,Kacyiru Branch, Area 2: Ruyenzi, Nyarugenge Branch) were selected. ・The preparation work in order to setting up DMA is beeing conducted such as procurement of the equipments and construction of chambers, separation of tertiary distribution pipes and installation of valves in the network.. ・Implementation of the OJT activity is planned in the 2nd Phase.	
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodiclly monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		・Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was desided. ・Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey. ・Detailed design was done for preparation of technical specifications of the equipment of a monitoring system. Procurement work hasnot yet started. ・The chambers were designed and consuruction work is started from March 2017.	

Activities	Inputs		Pre-Conditions
	The Japanese Side	**The Rwanda Side**	
1-1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.	1 Experts Dispatch	1 Counterpart	
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.	Chief Adviser／Non-Revenue Water management	Project Director	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Non-Revenue Water reduction planning	Project Manager	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	GIS	Management team members	
1-5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.	Hydraulic analysis	Action team members	・GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Leak detection	Other counterparts	
1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.	Pipe repairing and service pipe connection		
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	ICT		
1-9 The management team prepares the 5-year Strategic Acton Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.			
1-10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	**<Issues and countermesures>**
1-12 Seminars are organized to present all the achievements of the project for WASAC and other cconcerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017.
2-1 Training materials on NRW control are prepared.	Training in the 3rd country	Training room with the capacity of about 20 persons	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.		Space for training on pipe repair and service pipe connection（40㎡）	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Leak detection equipment		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Ultrasonic flow meter with data logger	3 Local cost	Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule.
2-6 In-room training and OJT on reparing leaking pipies and installing service connection for the pilot project are conducted.	Gate valve, flow meter, and customer meter for Pilot Project	Cost for administering the Project (utilities for experts offices, internet services)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8 Training materials on NRW are reviewed and updated.	Equipment for training on pipe repair and service pipe connection	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Mobile GPS	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1.	Vehicles for Japanese experts		In the beginning of September, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of
3-2 The action team grasps the current situations of Pilot Area 1 through reviewing available maps, cusomer ledgers, surveys, and other necessary means.			
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1.			
3-4 The action team hydraulically isolates Pilot Area 1, and installs flow meters and preassure gauges at the inlets of the Pilot Area 1.			
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.			

3-6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikUrban was made by Esri in the end of October.
3-7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8	The action team conducts measures for reducing surface leakage (visible leakage).			
3-9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10	The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12	The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.			
3-13	The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.			
3-15	Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.			
3-16	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
4-1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.			
4-4	System input to each of 4 branches is measured.			
4-5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.			

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 2
Dated March 13,2017

Project Title:Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs	Plan/Actual	1st Year I	1st Year II	1st Year III	1st Year IV	2nd Year I	2nd Year II	2nd Year III	2nd Year IV	3rd Year I	3rd Year II	3rd Year III	3rd Year IV	Remarks	Monitoring: Issue	Monitoring: Solution
Expert		8, 9	10, 11, 12	1, 2, 3	4, 5, 6	7, 8, 9	10, 11, 12	1, 2, 3	4, 5, 6	7, 8, 9	10, 11, 12	1, 2, 3	4, 5, 6			
Chief Adviser/Non-Revenue Water Management	Plan														N/A	N/A
	Actual															
Adviser/Non-Revenue Water Management	Plan														N/A	N/A
	Actual															
NRW Reduction Plan 1(1)	Plan														N/A	N/A
	Actual															
NRW Reduction Plan 1(2)	Plan														N/A	N/A
	Actual															
NRW Reduction Plan 2(1)	Plan														N/A	N/A
	Actual															
NRW Reduction Plan 2(2)	Plan														N/A	N/A
	Actual															
Geographic Information System: GIS	Plan														N/A	N/A
	Actual															
Hydraulic Analysis	Plan														N/A	N/A
	Actual															
Leak Detection	Plan														N/A	N/A
	Actual															
Pipe Repairing and Service Connection(1)	Plan														N/A	N/A
	Actual															
Pipe Repairing and Service Connection(2)	Plan														N/A	N/A
	Actual															
Information and Communication Technology: ICT	Plan														N/A	N/A
	Actual															
Equipment																
Lot 1: Equipment for training on pipe repair and service pipe connection	Plan														N/A	N/A
	Actual															
Lot 2: Pilot Projects (Customer Meter)	Plan														N/A	N/A
	Actual															
Lot 3: Pilot Projects (Gate valve, flow meter, and customer meter)	Plan														N/A	N/A
	Actual															
Lot 4: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)	Plan														N/A	N/A
	Actual															
Lot 5: Vehicles for Japanese experts	Plan														N/A	N/A
	Actual															
Lot 6: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc)	Plan														N/A	N/A
	Actual															
Lot 7: Mobile GPS, Potable Test meter etc	Plan														N/A	N/A
	Actual															
Training in Japan																
25 persons will be trained in Japan (5, 10, 10)	Plan														N/A	N/A
	Actual															
In-country/Third country Training																
	Plan															
	Actual															

Activities / Sub-Activities	Plan/Actual	1st Year I	1st Year II	1st Year III	1st Year IV	2nd Year I	2nd Year II	2nd Year III	2nd Year IV	3rd Year I	3rd Year II	3rd Year III	3rd Year IV	Responsible Organization: Japan	Responsible Organization: RWANDA	Achievements	Issue & Countermeasures
Output 1: Planning capacity of NRW reduction of WASAC is enhanced.		8, 9	10, 11, 12	1, 2, 3	4, 5, 6	7, 8, 9	10, 11, 12	1, 2, 3	4, 5, 6	7, 8, 9	10, 11, 12	1, 2, 3	4, 5, 6				
1.1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.	Plan													Expert	WASAC	Member of the Team are appointed.	N/A
	Actual																
1.2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.	Plan													Expert	WASAC	in progress	N/A
	Actual																
1.3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.9 The management team prepares the 5-year Strategic Acton Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan													Expert	WASAC	N/A	N/A
	Actual																
1.12 Seminars are organized to present all the achievements of the project for WASAC and other cconcerned parties.	Plan													Expert	WASAC	N/A	N/A
	Actual																
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.																	
2.1 Training materials on NRW control are prepared.	Plan													Expert	WASAC	in progress	N/A
	Actual																
2.2 Training on NRW management is conducted for the management team and WASAC	Plan													Expert	WASAC	N/A	N/A
	Actual																
2.3 OJT is conducted on the updating of GIS data, using available GIS data base.	Plan													Expert	WASAC	in progress	N/A
	Actual																
2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan													Expert	WASAC	in progress	N/A
	Actual																
2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan													Expert	WASAC	N/A	N/A
	Actual																
2.6 In-room training and OJT on reparing leaking pipies and installing service connection for the pilot project are conducted.	Plan													Expert	WASAC	N/A	N/A
	Actual																
2.7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan													Expert	WASAC	N/A	N/A
	Actual																
2.8 Training materials on NRW are reviewed and updated.	Plan													Expert	WASAC	N/A	N/A
	Actual																
2.9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan													Expert	WASAC	N/A	N/A
	Actual																
Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.																	
3.1 An action team is organized to conduct NRW reduction measures at Pilot Area 1and Area 2.	Plan													Expert	WASAC	Member of the Team are appointed.	N/A
	Actual																
3.2 The action team grasps the current situations of Pilot Area 1and Area 2 through reviewing available maps, cusomer ledgers, surveys, and other necessary means.	Plan													Expert	WASAC	in progress	N/A
	Actual																
3.3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	Plan													Expert	WASAC	N/A	N/A
	Actual																
3.4 The action team hydraulically isolates Pilot Area 1and Area 2, and installs flow meters and preassure gauges at the inlets of the Pilot Area 1.	Plan													Expert	WASAC	in progress	N/A
	Actual					Procurement of Equipment and Construction of Chamber											

No.	Activity				Issue	Solution
3.5	The action team establishes the baseline NRW rate of Pilot Area 1.	Plan / Actual	Expert	WASAC	N/A	N/A
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Plan / Actual	Expert	WASAC	N/A	N/A
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	Expert	WASAC	N/A	N/A
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan / Actual	Expert	WASAC	N/A	N/A
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual	Expert	WASAC	N/A	N/A
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan / Actual	Expert	WASAC	N/A	N/A
3.11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual	Expert	WASAC	N/A	N/A
3.12	The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.	Plan / Actual	Expert	WASAC	N/A	N/A
3.13	The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.	Plan / Actual	Expert	WASAC	N/A	N/A
3.14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.	Plan / Actual	Expert	WASAC	N/A	N/A
3.15	Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.	Plan / Actual	Expert	WASAC	N/A	N/A
3.16	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.	Plan / Actual	Expert	WASAC	N/A	N/A
Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.						
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan / Actual	Expert	WASAC	in progress	N/A
4.2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan / Actual	Expert	WASAC	N/A	N/A
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.	Plan / Actual (Construction of Chamber; Procurement of Equipment; Installation of Equipment)	Expert	WASAC	N/A	N/A
4.4	System input to each of 4 branches is measured.	Plan / Actual	Expert	WASAC	N/A	N/A
4.5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.	Plan / Actual	Expert	WASAC	N/A	N/A

Duration / Phasing — Plan / Actual

Monitoring Plan — Plan / Actual

1st Year: I (8, 9), II (10, 11, 12), III (1, 2, 3), IV (4, 5, 6); 2nd Year: I (7, 8, 9), II (10, 11, 12), III (1, 2, 3), IV (4, 5, 6); 3rd Year: I (7, 8, 9), II (10, 11, 12), III (1, 2, 3), IV (4, 5, 6)

Item		Remarks	Issue	Solution
Monitoring				
Joint Coordination Committee	Plan / Actual	Project Kik-off meeting was held on Aug. 18, 2016.	N/A	N/A
Set-up the Detailed Plan of Operation	Plan / Actual	Work Plan was submitted to WSAC on Aug. 18, 2016.	N/A	N/A
Submission of Monitoring Sheet	Plan / Actual		N/A	N/A
Monitoring Mission from Japan	Plan / Actual		N/A	N/A
Joint Monitoring	Plan / Actual		N/A	N/A
Post Monitoring	Plan / Actual			
Reports/Documents				
Inception Report	Plan / Actual			
Progress Report	Plan / Actual		N/A	N/A
Project Completion Report	Plan / Actual		N/A	N/A
Public Relations				
Seminars and Workshops	Plan / Actual		N/A	N/A

PM Form 3-1　Monitoring Sheet Summary

TO CR of JICA　RWANDA　OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet　: Ver.3（Term: August, 2016 – June, 2017: 1st Phase）

Name: Shigeo OTANI
Title: Chief Advisor/ Non-Revenue Management

Submission Date: August 8, 2017

I. Summary

1　Progress

1-1　Progress of Inputs

1-1-1　Japan Side

(1)　List and Assignment Terms of Japanese Experts

a. Working in Rwanda

Table 1.1 Assignment Term in Rwanda

Field in Charge		Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/14	2016/12/11	4.00
			2017/1/15	2016/4/6	2.73
			2017/5/1	2016/5/31	1.03
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2016/8/14	2016/9/27	1.50
			2017/1/15	2017/2/28	1.50
			2017/4/1	2017/6/2	2.07
3	NRW Reduction Plan 1（1）	Chiaki SUZUKI	2016/8/15	2016/9/13	1.00
			2016/11/10	2016/12/27	1.60
			2017/4/1	2017/5/31	2.03
4	NRW Reduction Plan 1（2）	Hiroyasu YODA	2016/9/7	2016/11/14	2.30
			2017/1/15	2017/4/10	2.87
5	NRW Reduction Plan 2（1）	Toru TOYODA	2016/8/15	2016/9/28	1.50
			2017/1/15	2017/4/8	2.80
6	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2016/9/18	2016/12/16	3.00
			2017/3/18	2017/5/31	2.50
7	GIS	Eita HORISHITA	2016/8/14	2016/11/11	3.00
8	Hydraulic Analysis	Hiroki OE	2016/8/15	2016/11/12	3.00
9	Leak Detection	Junichi TAKAHASHI	2017/3/3	2017/5/31	3.00
10	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2017/4/2	2017/6/2	2.07
11	Pipe Repairing and Service Connection（2）	Hiroshi TAKASHIMA	2017/1/15	2017/4/14	3.00
12	ICT	Marcel Brouwer	2016/9/30	2016/12/10	2.40
			2017/2/13	2017/2/13	0.03
			2017/3/1	2017/4/21	1.73
			2017/5/8	2017/5/31	0.80
Total M/M					51.46

b. Working in Japan

Table 1.2 Assignment Term in Japan

No.	Field in Charge	Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/5	2016/8/12	0.25
			2017/4/17	2017/4/21	0.25
10	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2016/9/26	2016/9/30	0.50
			2016/10/3	2016/10/7	
Total M/M					1.00

Details of each expert's assignment are shown in the Plan of Operation (see Project Monitoring Sheet-II "Plan of Operation).

(2) List of Equipment Provided for the Project

Table 1.3　List of Equipment

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1 *	Output 2	Materials and equipments for training for pipe repairing and service connection	set	1	Consultant	May. 2017 Completed	not yet
Lot 2 *	Output 3	Customer mater φ15mm	sets	400	Consultant	Feb. 2017 Completed	not yet
Lot 3 *	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Consultant	May. 2017 Completed	not yet
Lot 4 *	Output 4: Isolation of 4 Branch	Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.	set	1	JICA office	Nov. 2017 Scheduled	not yet
Lot 5	Vehicles for JICA use	Onebox and Pickup	Units	2	JICA office	Jan. 2017 Completed	not yet

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity		Schedule	Handover to WASAC
Lot 6 *	Output 2: Leak detection equipment（for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	sets	3	JICA HQ	Jul. 2017 Scheduled	not yet
Lot 7 *	Survey Equipment for Output 2and 3	Potable GPS, Potable Test Meter, Residual Chlorine Test Meter, Potable Electric conductivity Meter	set	1	Consultant	Oct. 2016 Completed	not yet

Note: Those items will be used for the training activity during the Project period.
During the Project period, the above mentioned equipment will be utilized and managed by the Project.

1-1-2 Rwanda Side

(1) Counterpart

Table 1.4 List and Assignment Terms of Counterparts

No	Field in Charge	Name	Duration	
			From	To
Steering Committee (SC)				
1	Chairman: CEO of WASAC	James Sano	Aug. 2016	Present
2	Project Director: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
3	Project Manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
4	Management Team		Aug. 2016	Present
5	Officials from MINIFRA		Aug. 2016	Present
Project Director and Manager				
1	Project Director: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
2	Project manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
Management Team (8 persons)				
1	Leader: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
2	Co-leader: Director of CS	Lucien Ruterana	Aug. 2016	Present
3	Co-leader: Director of CFO	Joseph Ruhingura	Aug. 2016	Present
4	Project manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
5	Manager of Water Operation Services, UWSS	Innocent Gashugi	Aug. 2016	Present
6	Manager of Utility Planning Services, UWSS	Dominic Murekezi	Aug. 2016	Present
7	Manager of Revenue Management Services, CS	Désiré Kayiru	Aug. 2016	Present
8	Manager of Customer Service Management, CS	Felix Gatanazi	Aug. 2016	Present
Action Team (31 persons)				
1	Leader: Head of leak detection and pressure management, NRW, UWSS	Désiré Ntamuturano	Aug. 2016	Present
2	Co-Leader: Kachiru Branch Manager	Musabyeyez Jeanne	Aug. 2016	Present
3	Co-Leader: Gikondo Branch Manager	Mutamba Jane	Aug. 2016	Present
4	Co-Leader: Nyarugenge Branch Manager	Byamugisha Bernard	Aug. 2016	Present
5	Co-Leader: Nyamirambo Branch Manager	Saranda Catherine	Aug. 2016	Present
6	Co-Leader: Kanonbe Branch Manager	Aimable Ndagijimana	Aug. 2016	Present
7	Co-Leader: Remera Branch Manager	Gilbert Mulindabigwi	Aug. 2016	Present
8	Head of zoning and mapping services, NRW, UWSS	Jean Paul Kayitare	Aug. 2016	Present
9	Head of water distribution services, WOS, UWSS	Anselme Mugabo Kimenyi	Aug. 2016	Present
10	Leak detection and pressure management Officer	Celestin Mwambutsa	Aug. 2016	Present
11	Fraud Investigation Officer	Viateur Munyanshongore	Aug. 2016	Present
12	Mapping Officer	Claudien Mazimpaka	Aug. 2016	Present
13	Head of meter management services	Felecien Niringiyimana	Oct. 2016	Present
14	Water Distribution Officer of each Branch		Aug. 2016	Present
15	Customer Service Officer of each Branch		Aug. 2016	Present
16	Billing Officer of each Branch		Aug. 2016	Present

Table 1.5　Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Mr. Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Mr. Celestin MWAMBUTSA	Leak detection and pressure management Officer
Output 3	Mr.Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Mr. Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

(2)　Facilities

- Office space for Japanese experts at WASAC Head Office, office furniture
- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

(3) Local Cost

- Cost for administering the Project (utilities for experts offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project for 1st Phase

Start-up Meeting of the Project was held Aug. 16 at Galaxy Hotel in Kigali with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Introduction of JICA experts and Counterparts (C/P)
- Explanation and discussion of draft of Work Plan (WP)
- Confirmation of understanding of the project contents (Implementation Schedule).
- Condition for selection of pilot project area
- Selection of the members of Action teams and other related teams
- Notes for safety measures
- Agenda and facilitator of the Seminar (Kick-Off Meeting) of August 18th.

The minutes of meeting is attached in Annex 2.

(2) Kick-Off Meeting of the Project

Kick-Off Meeting was held on Aug. 18, 2016 at Galaxy Hotel in Kigli to show the contents of the project to person concerned such as Management Team, Action Team, all Branch managers of WASAC and MININFRA. The main topics of the meeting ware as follows:

- Explanation of Project Objectives
- Project implementation Structure
- Project Implementation Flowchart
- Introduction of NRW reduction of Yokohama City
- Discussion

(3) Management Meeting (Joint Monitoring)

In the joint monitoring conducted at the management team meeting held on March 15, 2017, it was pointed out that the preparation of the 5-year Action Plan for NRW Reduction was delayed for about three months and, therefore, the work plan was reviewed.

Furthermore, it was agreed upon to prepare a draft-version 5-year Action Plan for NRW Reduction by the end of May and report it to the Management Team and all the branch managers at the seminar (to be held on Friday, May 29). As a result of consultation with WASAC, it was agreed upon that the draft version would describe a framework of the project including priority measures, general schedule, and organizations in charge and that the 5-year Action Plan for NRW Reduction would be prepared in June and later. Management Team meetings is to be held once at the end of every month, where the activities carried out by the Action Team are reported, the policies for implementation of the project are approved, and discussions are held regarding coordination between departments in connection with activities, etc. Table below shows the topics discussed.

The minutes of meeting on March 15 is attached in Annex 3.

Table 1.6　Management Team Meetings and Topics Discussed

Meeting	Timing	Themes and topics
No. 1	March 15, 2017	・Confirmation of the progress of implementation of the 1st Phase activities ・Discussion of the way of proceeding on 5-year strategic action Plan for NRW Reduction
No. 2	May 12, 2017	・Confirmation of the progress of implementation of the 1st Phase activities ・Confirmation of the policy for the 2nd Phase activities ・Aagenda of the seminar for the framework of 5-year strategic action Plan for NRW Reduction

(4) Steering Committee

Steering Committee was held April 3, 2017 at Galaxy Hotel in Kigli with participation of members of Management Team, Action Team and MININFRA. The main topics of the meeting were as follows:

- Report of the Project progress
- Carrying forward works to the 2nd Phase

Followings has been approved that these activities will continue to carry out in 2nd Phase.

Activity of Output 1, the preparation work of 5-year Strategic Action Plan for NRW Reduction, is extended by 3 months to the end of August 2017.

Activity of Output 4, construction of monitoring system, is extended due to the delay in procurement of equipment.

- General explanation of Work Plan 2

The minutes of meeting is attached in Annex 4.

(5) Weekly Meeting

As a rule the regular meetings were held at the end of every week, at which the activities for the week were reported, the activities scheduled for the following week were confirmed and pending issue, and matters of concern, requests, etc., were discussed. Also it was utilized as a venue for training, such as explanation of matters proposed by the specialists, etc.

Table 1.7 Action Team meetings and Topics Discussed

Meeting	Timing	Themes and topics
No. 1	August 26, 2016	Work Plan detailed explanation, pilot sites, explanation of procedures relating to hydraulic isolation of the water networks of the branches
No. 2	September 2, 2016	Introduction of the example of DMA in Yokohama City, discussion regarding boundaries between branches (included each branch head), discussion regarding selection of pilot projects
No. 3	September 9, 2016	Selection of pilot sites, coordination of branch surveys outside Kigali City
No. 4	September 19, 2016	Confirmation of pilot site selection survey, confirmation of hydraulic isolation of the water networks of the branches
No. 5	September 23, 2016	Requests for return of branch questionnaires, report on survey outside Kigali city, confirmation of boundaries between branches, use of hydraulic analysis software
No. 6	September 30, 2016	Determination of boundaries between branches, confirmation of procedure for implementation of trial excavation survey for chamber construction, confirmation of pilot site inflow points
No. 7	October 7, 2016	Seminar regarding status of survey regarding hydraulic isolation of water networks of the branches, and proposal of NRW strategy (countermeasures against non-delivery of water and theft of water)
No. 8	October 14, 2016	Seminar regarding confirmation of positions of hydraulic isolation of water networks of the branches, and inventory surveys (confirmation of water meters, customer information and GIS facility information)

Meeting	Timing	Themes and topics
No. 9	October 24, 2016	Seminar regarding questionnaires on NRW Strategic Action Plan, discussion regarding holding workshops, and analysis and countermeasures relating to public water hydrants and large-scale customers
No. 10	October 28, 2016	Seminar regarding confirmation of positions of hydraulic isolation of branches, and asset management (renewal), DMA construction, and analysis and countermeasures against illegal connections
No. 11	November 4, 2016	Workshop on status of trial excavation surveys for hydraulic isolation of water networks of the branches, and formulation of activity priorities in the NRW Strategic Action Plan
No. 12	November 11, 2016	Status of trial excavation surveys for hydraulic isolation of branches, and recommendations to WASAC regarding the direction of customer service
No. 13	November 18, 2016	Final confirmation of the positions of installation of hydraulic isolation of water networks of the branches
No. 14	November 25, 2016	Final confirmation of the pilot area inflow points, and final confirmation of the equipment, specifications, and chambers
No. 15	January 20, 2017	Explanation of the draft framework of the NRW Strategic Action Plan based on the workshop, discussion regarding formulation of the NRW Strategic Action Plan, implementation of the inventory survey in order to obtain the insufficient data
No. 16	January 27, 2017	Seminar regarding the report on delay of equipment procurement, survey of regional branches, and measures for implementation of the pilot project
No. 17	February 3, 2017	Chamber construction tenders, regional branch survey results
No. 18	February 10, 2017	Seminar on implementation of the WASAC inventory survey, regional branch survey results, chamber construction pending items, and raising awareness
No. 19	February 17, 2017	Seminar on progress of the inventory survey, discussion regarding the draft contents of the NRW Strategic Action Plan, progress of the chambers and equipment procurement, coordination of the Management and SC meetings, and status of high water distribution pressure and methods of analysis
No. 20	February 24, 2017	Seminar regarding results of the regional branch survey, progress of the inventory survey, discussion regarding the method of formulation of the NRW Strategic Action Plan, and the effect and importance of pipe renewal
No. 21	March 3, 2017	Results of the regional branch survey, progress of the inventory survey, discussion regarding the method of formulation of the NRW Strategic Action Plan, chamber construction pending items.
No. 22	March 10, 2017	Results of the regional branch survey, progress of the inventory survey, chamber construction pending items, and seminar introducing the example of NRW reduction measures in Indonesia
No. 23	March 17, 2017	SC meeting coordination, activity progress, and chamber construction pending items
No. 24	March 24, 2017	SC meeting coordination, activity progress, chamber construction pending items, and seminar regarding water meters and their specifications
No. 25	April 19, 2017	Progress of the inventory survey, seminar to reconfirm the method of formulation of the NRW Strategic Action Plan, and the water leakage detection survey and analysis results

Meeting	Timing	Themes and topics
No. 26	May 3, 2017	Chamber construction pending items, SC seminar, confirmation of the details of the joint seminar on water leak detection and distribution pipe repair
No. 27	May 19, 2017	Chamber construction pending items, progress of the inventory survey, confirmation of the timing for holding the Strategic Action Plan for NRW Reduction Workshop, details of the seminar on high water pressure and hydraulic analysis

(6) Revision of Work Plan

The draft of Work Plan was presented by JICA Expert Team at Start-up Meeting of the Project, and Kick-Off Meeting of the Project. It was revised on Sept. 15, 2016 as Ver.1 and on March 13, 2017 as Ver.2 according to progress of the meantime. The Work Plan Ver.2 is attached in Annex 5.

(7) Project Progress Report (Part 1)

Project Progress Report was prepared at the end of 1st Phase of the Project. The Project Progress is as attached in Annex 6.

1-2-2: Training in Japan and in the 3rd Country

(1) Tanning in Japan

Table 1.8 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5 persons	- Introduction to water service management and NRW - Outline of water facilities in Yokohama and Kobe Cities and other matters
2	August 14 to 30, 2017 (planned)	Business affairs and GIS matter	10 persons	- Introduction to water service management and NRW - Customer information management, meter management and reading, and water service management - Examples of how local governments utilize GIS, purposes of use, and other matters
3	November 2017 (planned)	Technical matter	10 persons	Introduction to NRW, pressure management, leak detection, distribution management, and other matters (under review)

The following member participated in the training in Japan between January 1, 2016 and February 2, 2017.

Table 1.9 Member of 1st Training in Japan

	Names	Position
1	RUTAGUMGIRA Methode	Director , Urban Water and Sewerage Services (Project Director)
2	BAHIGE Jean Berchmans	Manager, Non-Revenue Water (Project Manager)
3	GATANAZI Felix	Manager, Customer services
4	BYAMUGISHA Bernard	Head of Branch /Nyarugenge
5	MUTAMBA Jane	Head of Branch /Gikondo

Table 1.10 Schedule of 1st Training in Japan

No	Day		Travel	Type	Contents	Organizer
1	2017/1/21	Sat	Kigali→			
2	2017/1/22	Sun	Yokohama		Arrival	
3	2017/1/23	Mon	Yokohama	Lecture	Training briefing Programmee Orientation Distribution management system Courtesy call to the Yokohama City Water Works Bureau	JICA Yokohama Yokohama City Water Works Bureau
4	2017/1/24	Tue	Yokohama	Lecture	Block system of Yokohama City Customer Meter Management	Yokohama City Water Works Bureau
5	2017/1/25	Wed	Yokohama	Practical training, Visit	Mapping system Visit a Water Service Memorial Visit at Water Treatment Plant (Nishiya)	Yokohama City Water Works Bureau WTP of Yokohama City
6	2017/1/26	Thu	Yokohama	Lecture Practical training	Quality control and inspection system of service connection Leakage Detection Survey	Yokohama City Water Works Bureau WTP of Yokohama City
7	2017/1/27	Fri	Yokohama		Discussion, Training Evaluation Closing meeting	JICA Yokohama
8	2017/1/28	Sat	Yokohama→ Kyoto			
9	2017/1/29	Sun	Kyoto→Kobe			
10	2017/1/30	Mon	Kobe	Lecture, Visit	Courtesy call to the Kobe City Water Works Bureau History of the City Water Works Visit to facilities	Kobe City Water Works Bureau
11	2017/1/31	Tue	Kobe	Lecture, Visit	NRW Reduction Measure Pressure Management Water Demand Projection Visit to facilities	Kobe City Water Works Bureau
12	2017/2/1	Wed	Kobe→ Yokohama		Discussion, Training Evaluation Closing meeting	JICA Kansai
13	2017/2/2	Wed	Tokyo→Kigali		Departure	

(2)　Training in the 3rd country

Not yet conducted

1-2-3: Activities of Output

【Activities of Output 1】

: Planning capacity of NRW reduction of WASAC is enhanced.

1-1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.

The member of the management team is appointed formally in August 2018 by CEO, and formation is finished.

1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.

- Questionnaire survey has conducted for 20 Branch Offices in September 2016 and the answers to the questionnaire are summarized in October 2016. The result was explained for NRW team and discussed it on November 8, 2016 .
- Site visit survey for three Branch Offices, Ruwamagana, Nagatare and Ngoma, was conducted in September 2016 to confirm existing activities of WASAC branch offices, the situations of facilities, and evaluate it.
- The site visit survey for remaining 11 Branch offices (Musanze, Ruvavu, Gicumbi, Ruhango, Nyanza, Huye, Nyamagabe, Karongi, Rusizi, Bugesera, Muhango) was conducted from the middle of February until the beginning of March, 2017.
- Based on the process shown in table below, information was shared at each meeting and workshop, and WASAC identified the issues regarding measures against non-revenue water.

Table 1.11　Process of Assess NRW Reduction Measures

No	Item	Implementation period	Details
1	Distribution of questionnaires to the 20 branches	Sept. 2016	Organization, outline of water supply facilities, customer information, NRW percentage, flow rate meters, water leakage investigation equipment, pipe repair equipment, water theft, water meters, etc.
2	Analysis of questionnaires	Sept.-Oct.2016	
3	Seminar	Nov. 8, 2016	on the questionnaire analysis results
4	Field surveys and reporting and issue identification at weekly meeting	Sept.2016 to March 2017	Confirmation of questionnaires, visits to facilities, interviews with branch managers, operators, etc., sharing survey results.
5	NRW strategic action plan workshop GP1	March 20-22, 2017	NRW reduction plan: Workshop on identification of issues

From the WASAC side, many issues were identified, such as (1) Organization (low priority for NRW reduction within WASAC, insufficient personnel and budget, insufficient coordination between departments), (2) Systems (NRW reduction procedures, regulations for new water supply connections (existing pipe connections, material selection), insufficient sharing of information between branches), (3) Equipment (insufficient pipe materials, heavy machinery, vehicles, tools, etc.), (4) Knowledge/awareness of the personnel (insufficient specialist technologies, insufficient ownership), (5) Asset management (maintenance, renewal of pipelines and valves). From the specialist side the issues were, a: Design/standards/records (long-term renewal plans, various types of design, material standards, criteria for new connections, drawings, insufficient control documents), b: Management of outsourced construction

(insufficient inspection after appointment of contractor), c: Accuracy of basic data (GIS, customer data, details of various types of facility, drawings). Also, issues regarding facilities that were recognized in common included systems for measuring NRW percentage, high water distribution pressures (water delivery pipe branches, water delivery pumps, locations of water distribution reservoirs), water leakage surveys, repair of distribution pipe, management of water meters, management of public water hydrants, management of water theft, etc.

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

From the information obtained in Activity 1-2 and the survey of the 6 branches within Kigali City and the existing water supply facilities (field surveys, questionnaires, GIS, water consumption data), the issues were identified, and the countermeasures and orders of priority as of November 2016 are summarized in the Table below.

Table 1.12　Countermeasures against NRW (proposals as of November 2016)

Topic	Measures	Total			Evaluation
		Yes	No	Priority	
Topic−1: WASAC Strategy	○Attention shall be paid not only to customers but also to non-served population	0	0	6	High
	○WASAC should carry out household surveys at 20 branches, visiting non-served households and illegal water users	0	0	7	
	○WASAC shall register illegal water users as normal customers	0	3	2	
	○WASAC shall prepare a conceptual long term development plan	0	0	9	High
Topic−2: Needs of Quality Data	○Customer survey at all branches	0	0	8	
	○On-site meter calibration	0	0	8	
	○Update all customer data	0	0	11	
	○Meter replacement at all branches	0	0	6	
	○Update and validate GIS pipe network	0	0	10	
	○Incorporate as-built drawings, sketches, etc. into GIS	0	0	7	
Topic−3: Outline of Public Taps	○Carry out public standpipe survey	0	0	7	
	○Replace/repair malfunctioning meters (public standpipes)	0	0	10	
	○Upgrade GIS maps (public standpipes)	0	0	7	
	○Shift the abandoned standpipes to the suburban areas	0	2	3	
Topic−4: Large Customers	○Study on introduction of industrial water supply systems	0	2	3	
	○Carry out questionnaire survey (large	0	0	7	High
	○Analyze customer behavior, future water demand, etc.	0	0	8	
	○ Enhance water saving practices	0	1	4	
Topic−5: Asset Management	○Replace 200mm PVC with new ones based on F/S	0	1	7	High
	○Carry out priority analyses for pipe	0	0	11	
	○Continue rehabilitation of old pipes (i.e., 34km in 2015/2016) based on priority analyses	0	0	11	
	○Proper design (1)-water hammer effects, thrust blocks, BPT/PRV,	0	0	8	
	○Proper design (2)- No large dia. PVC pipes, flexible joints, sand beds, etc.	0	1	6	
	○Introduce 3D zoning system	0	0	6	
	○Inlets to DMA less than 3 in number	0	1	4	
	○Keep space for expansion as multi-function chambers (DMA's inlets flow meter chambers)	0	1	4	
	○Install gate valves properly within service pipe network	0	0	8	High
	○Deal transmission mains separately with distribution mains	0	0	8	
	○Service connections only from service pipe network, not from trunk/limb mains	0	0	10	
Topic−6: Illegal Water Users	○Continue survey on illegal water users	0	0	8	
	○Keep close dialogue with them	0	1	4	
	○Punishment shall be minimized as far as	0	4	2	

Thereafter a series of workshops were held, based on the wishes from the WASAC side for more detailed investigation of the issues and causes. The framework of the 5-year Action Plan for NRW Reduction formulated through the workshops.

Table 1.13 Process of workshop for 5-year Strategic Action Plan for NRW reduction

No	Item	Date	Details
1	GP2	April 5-6, 2017	Workshop to analyze causes, formulate measures, and select components
2	GP3	April 21, 27-28, 2017	Workshop to compare and combine the issues identified by JICA specialists and the issues and measures identified by WASAC
3	GP4	May 5, 12, 15 and 22, 2017	Workshop regarding the selected components, formulation of order of priority of countermeasures, and establishment of framework
4	Seminar	May 29, 2017	The framework for the 5-year Action Plan for NRW Reduction was approved
5	GP5	2nd Phase	Formulation of specific action plan for corresponding measures
6	GP6	2nd Phase	Allocation of organizational roles for action plan, and calculation of preliminary costs

In the table, the methods of dealing with issues were grouped, forming 18 fields (105 countermeasure items), to form the main components of the 5-year Action Plan for NRW Reduction. These were classified based on the International Water Association (IWA) water balance table. Also, an order of priority was set for the 105 countermeasure items, and the year of implementation and sections responsible were formulated. Table of next page shows an overview of the framework of the 5-year Action Plan for NRW Reduction.

The framework for the 5-year Action Plan for NRW Reduction was approved by the seminar held on May 29, 2017.

Table 1.14 Main components and priority of each method of solving

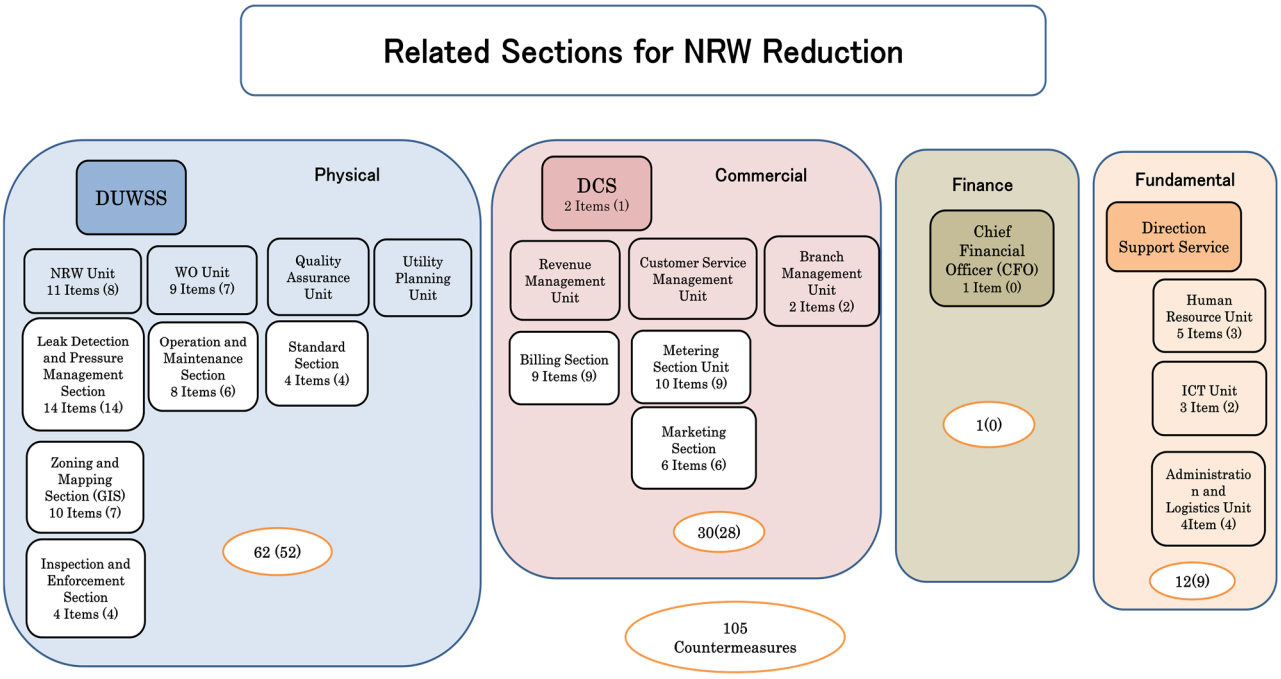
No.	Components	Sub No.	Countermeasures	Priority	Responsible Section/Branch	2016/2017 Preparation	2017/2018 1st Year	2018/2019 2nd Year	2019/2020 3rd Year	2020/2021 4th Year	2021/2022 5th Year
JICA NRW Reduction Project						←	—	→			
A. System Input Volume											
1	Volume input metering accuracy	1.1	Analysis of current condition of bulk meters	High	Metering section	x	x				
		1.2	Replace fault bulk meter based on the result of meter condition analysis	High	Metering section		x	x			
2	Water production (prevent intermittent supply)	2.1	Planning with projection of future demand	High	Planning unit	x	x	x	x	x	x
		2.2	Increase water production and upgrade of forwarding infrastructures	High	WOP unit	x	x	x	x	x	x
		2.3	Backup generators at pumping stations and WTP (Long term)	low	WOP unit				x	x	x
B. Commercial Losses											
3	Meter reading and billing (100% billing based on the actual measurement)	3.1	Regular meter reading , meter condition inspection and report	High	Billing section	x	x	x	x	x	x
		3.2	Improve technology for meter reading (Automatic Meter Reading)	High	Metering section			x	x	x	x
		3.3	CFO's should focus on meter reading , inspection ,reporting	High	Billing section		x	x	x	x	x
		3.4	Regular on site reading inspection by billing inspectors	High	Billing section		x	x	x	x	x
		3.5	Ensure internet connection availability for all WASAC service areas	High	IT Section		x	x	x	x	x
		3.6	Avail tool and equipment (meter reading gadget , mobile printers , rain caot, uniforms …	High	Billing section		x		x		x
4	Customers meter management (normal, lages and public tap) (Improve metering accuracy)	4.1	Conduct customer inventory and mapping in all WASAC branches	High	Zoning and mapping Section		x				
		4.2	Update all customer data in CMS	High	IT Section		x	x	x	x	x
		4.3	Meter replacement based on customer inventory result analysis and sampling result test	High	Metering section		x	x	x	x	x
		4.4	Make a plan and implement the investigation of customer meters and installations	High	Inspection and Enforcement Section		x			x	
		4.5	Regular meter test and calibration	High	Metering section		x	x	x	x	x
		4.6	Reinforce supervision and inspection for new conncetion works	High	DUWSS		x	x	x	x	x
		4.7	Procure Portable meter test equipment (atleast 2 per branch)	High	Metering section		x				
		4.8	Reinforce the public tap management and their proper location following the masterplan development	High	Customer service management unit		x	x	x	x	x
		4.9	On site inspection of meter reading (random re-readings) by branch managers (atleast twice a month)	High	Branch managers		x	x	x	x	x
		4.10	On site inspection of meter reading (random re-readings) by the senior managers (atleast once a month)	High	WASAC Senior management		x	x	x	x	x
		4.11	Make a plan for meter sealing (large and commercial customers)	Low	Metering section		x	x	x	x	x
		4.12	Procure and install one water test bench per province	High	Metering section		x	x			
5	Customer database updat and analysis	5.1	Regular analysis of billing and consumption data	High	Billing section		x	x	x	x	x
		5.2	Analysis of estimated bills	High	Billing section		x	x	x	x	x
		5.3	Historical analysis of NRW components	High	NRW Unit		x	x	x	x	x
6	Illegal Connection	6.1	monthly systematic customer data analysis	High	Billing section		x	x	x	x	x
		6.2	inspenction of suspected customer connection based on customer data analysis	High	Inspection and Enforcement Section		x	x	x	x	x
		6.3	Disconnection of illegal and innactive connections	High	Billing section		x	x	x	x	x
		6.4	Monitoring of fines payment	High	Inspection and Enforcement Section		x	x	x	x	x
		6.5	Enhance Incentive for informers (including staff)	High	Inspection and Enforcement Section		x	x	x	x	x
		6.6	Customer awareness for illegal connection	High	Marketing section		x	x	x	x	x
C. Physical Losses											
7	Pressure management	7.1	Hydraulic analysis for determination of high pressure zones (startig by branches with high NRW)	High	GIS		x	x	x	x	x
		7.2	Determine the acceptable pressure range at customer tap	High	Leak detection and pressure management Section		x				
		7.3	Procure and install pressure gauges in the network	High	Leak detection and pressure management Section		x			x	
		7.4	High pressure zones survey (from hydraulic analysis)	High	Leak detection and pressure management Section		x	x	x	x	x
		7.5	Establish a Proper pressure management plan	High	Leak detection and pressure management Section		x				
		7.6	Pressure reduction activities based on previous result (PRV, BPT, rearengement of pumping station station and pipeline network)	High	Leak detection and pressure management Section		x	x	x	x	x
8	Asset Management (Rehabilitation)	8.1	Inventory ,drawing and mapping of all facilities	High	GIS	x	x	x	x	x	x
		8.2	Establish the maintenance and rehabilitaion plan (year 1) and implement in next years	High	Operation and maintenance section		x	x	x	x	x
		8.3	Prioritisation analysis for network rehabilitation	High	Operation and maintenance section		x				
		8.4	Replacement of aged and leaking pipes based on priority analysis	High	Operation and maintenance section			x	x	x	x
		8.5	Monitor the implementation of the maintenance plan	High	Operation and maintenance section			x	x	x	x
		8.6	Reinforce the protection (air valves,valves , break pressure tanks installation) and security of water infrastructures (manhol covers , fences …)	Low	Operation and maintenance section		x	x	x	x	x
9	Leaks and burst repair	9.1	Prepare (year 1) and implement (next years) the plan for leak detection (invisible)	High	Leak detection and pressure management Section		x	x	x	x	x
		9.2	Prepare a plan (year 1) for visible leakage survey and implement (next years)	High	Leak detection and pressure management Section		x	x	x	x	x
		9.3	Prepare a plan for (year 1) reservoir leaks and overflows monitoring and implement (next year)	High	Leak detection and pressure management Section		x	x	x	x	x
		9.4	Network survey activities (Flow measurement including Minimum NF)	High	Leak detection and pressure management Section			x	x	x	x
		9.5	Reporting, reparing and recording of leakages repairs	High	Leak detection and pressure management Section		x	x	x	x	x
		9.6	Extend the leak detection activities in branches	High	Leak detection and pressure management Section		x	x	x	x	x
		9.7	Avail leak detection tool and equipment at the branch level	High	Leak detection and pressure management Section		x				
		9.8	Ensure strategic store at branch level	High	DSS		x	x	x	x	x
		9.9	Establish water supply monitoring system (DMA, SCADA ,etc..)	High	Operation and maintenance section		x	x	x	x	x
		9.10	Make estimation of water lost trougth leakages	High	Leak detection and pressure management Section		x	x	x	x	x
		9.11	Make historirical analysis of leakages (location , diameter , material etc..)	High	Leak detection and pressure management Section		x	x	x	x	x

No.	Components	Sub No.	Countermeasures	Priority	Responsible Section/Branch	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
						Preparation	1st Year	2nd Year	3rd Year	4th Year	5th Year
D. Unbilled Authorized Consumption											
10	Unbilled Authorized Consumption	10.1	Verification if all fire hydrants are metered	high	Metering Section		x				
		10.2	Have a plan for network flushing	low	Operation and maintenance section		x				
		10.3	Estimation of water uses in network flushing , reservoir cleaning , fire hydrants	high	Operation and maintenance section		x	x	x	x	x
E. Fundamental Measures											
11	GIS and CMS database	11.1	Update water network maps (GIS)	High	GIS	x	x	x	x	x	x
		11.2	Avail maps (soft and hard copies) and sensitize staff for regular utilisation	High	GIS	x	x	x	x	x	x
		11.3	Establish a procedure of water network maps update	High	GIS		x				
		11.4	Complete customer identification and mapping	High	GIS		x				
		11.5	link GIS and CMS	low	GIS and IT		x	x			
		11.6	Avail GIS staff up to branch level	low	GIS			x			
		11.7	Branches to enable the updating customer and mapping data base procedure	low	GIS			x			
12	Planning, design and implementation of works	12.1	Develop long term master plan of water network	High	Planning Unit	x	x				
		12.2	Disseminate existing standard and design of water works	High	Standard Section	x	x	x	x	x	x
		12.3	Establish design validation procedures	High	Standard Section		x			x	
		12.4	Ensure compliance of standard and design of water infrastructure	High	Standard Section		x				
		12.5	Enforcement of inspection and supervision works construction including new connection	High	DUWSS		x	x	x	x	x
		12.6	Regular inspection and supervision of works	High	DUWSS		x	x	x	x	x
13	Policy and Standard	13.1	Establish a standard and procedures for meter(installation , location , replacement, protection), and new connection	High	Metering section		x				
		13.2	Establish standard for distribution pipes installation (soil handaling , pipe installation , protection , etc..)	midle	WOP services		x				
		13.3	Establish and ensure compliance of standard of material procurement (meter , pipes , fittings , etc..)	High	Standard Section		x	x	x	x	x
		13.4	Customize IWA water balance to WASAC (to clear understand NRW components)	High	NRW Unit and JICA		x				
		13.5	Review the NRW procedure manual	High	NRW Unit and JICA		x				
14	Awareness	14.1	Raise the awareness of customers and staff about leak reporting	High	Marketing section		x	x	x	x	x
		14.2	Raise staff awareness on NRW reduction and WASAC values	High	Marketing section		x	x	x	x	x
		14.3	Raise up customers awareness (TV and radio show , Open Day , magazines ,school ..)	High	Marketing section		x	x	x	x	x
		14.4	Enhance contractors awareness on NRW	High	Marketing section		x	x	x	x	x
15	Stakeholders management	15.1	Increase the collaboration with local authorities	High	Marketing section		x	x	x	x	x
		15.2	Reinforce inspection of contractors works	High	DUWSS		x	x	x	x	x
		15.3	certification of companies working in water supply sector	High	DUWSS			x	x	x	x
		15.4	Prepare an MOU with road constructor , Districts and other infrastructures agencies	High	DUWSS		x				
		15.5	Mobilize finance for CAPEX form Financial institutions (loan from commercial banks,) , Donors , etc…	low	CFO		x	x	x	x	x
		15.6	Mobilize Partners in NRW reduction projects	low	DUWSS		x	x	x	x	x
		15.7	benchmarking visits	low	DUWSS		x	x	x	x	x
		15.8	Collaboration with research centers and universities	low	DUWSS		x	x	x	x	x
		15.9	Involve local authority in infrastructures protection	High	DUWSS		x	x	x	x	x
		15.10	Improve communication with stakholders	High	DUWSS		x	x	x	x	x
16	Training	16.1	Assess current staff skill gap and prepare appropriate training plan(new connection standard , GIS usage, pipe installation,pressure management , etc..)	High	HR Unit		x	x	x	x	x
		16.2	Set up an internal knowledge transfers mecanism	High	HR Unit		x	x	x	x	x
		16.3	Benchmarking of different branches for NRW reduction	High	NRW		x	x	x	x	x
		16.4	Secure the budget for the training	High	HR Unit		x	x	x	x	x
17	Institution	17.1	Review branch structure (add more staff)	High	DCS		x				
		17.2	Review the NRW Unit structure	High	DUWSS		x				
		17.3	Establish a sufficient stock at the branch level	High	DSS		x	x	x	x	x
		17.4	Put in place a technical works inspection team	High	DUWSS		x				
		17.5	Reinforce the research and development	low	DUWSS		x	x	x	x	x
		17.6	Put in place Incentive measures for NRW reduction	High	DCS		x				
		17.7	Pro- poor consideration in WASAC strategies	low	DCS		x				
		17.8	Continuous improvement and innovation	low	DUWSS		x	x	x	x	x
18	Logistic and quality materials	18.1	Avail enough equipment and logistics (vehicle , motocycle , tools,protective equipment , etc…)	High	DSS		x	x	x	x	x
		18.2	Ensure the procurement of quality materials (for new connection and other water works)	High	DSS		x	x	x	x	x

Table 1.15 Responsible Section in WASAC for the Implementation of NRW Reduction Action Plan

IWA item	Component	No*	Responsible Section of WASAC
Quantity of system input	1. Volume input metering accuracy	2	Metering Section (DCS)
	2. Water production (prevent intermittent supply)	3	WOP Unit (DUWSS), Utility Planning Unit (DUWSS)
Commercial losses	3. Meter reading and billing (100% billing based on the actual measurement)	6	ICT Section (DSS), Billing Section (DCS), Metering Section (DCS)
	4. Customers meter management (normal and public tap) (Improve metering accuracy)	12	Zoning and Mapping Section: GIS (NRW of DUWSS), ICT Section (DSS), Inspection and Enforcement Section (NRW of DUWSS), Billing Section (DCS), Customer Service Management Unit (DCS), Metering Section (DCS), Branch Management Unit (DCS)
	5. Customer database update and analysis	3	NRW Unit (DUWSS), Billing Section (DCS)
	6. Illegal Connection	6	Inspection and Enforcement Section (NRW of DUWSS), Billing Section (DCS), Marketing Section (DCS)
Physical losses	7. Pressure management	6	Leak Detection and Pressure Management (NRW of DUWSS), Zoning and Mapping Section: GIS (NRW of DUWSS)
	8. Asset Management (Rehabilitation)	6	Leak Detection and Pressure Management (NRW of DUWSS), Zoning and Mapping Section: GIS (NRW of DUWSS), Operation and Maintenance Service (WO unit of DUWSS)
	9. Leaks and burst repair	11	Operation and Maintenance Service (WO unit of DUWSS), Administration and Logistics Unit (DSS)
Unbilled authorized consumption	10. Unbilled authorized consumption	3	Operation and Maintenance Service (WO unit of DUWSS), Metering Section (DCS)
Basic countermeasures	11. GIS and CMS database	7	Zoning and Mapping Section: GIS (NRW of DUWSS), ICT Section (DSS)
	12. Planning, design and implementation of works	6	WOP Unit (DUWSS), Utility Planning Unit (DUWSS), Standards Section (DUWSS)
	13. Policy and Standard	5	NRW Unit (DUWSS), WOP Unit (DUWSS), Standards Section (DUWSS), Metering Section (DCS)
	14. Awareness	4	Marketing Section (DCS)
	15. Stakeholders management	10	NRW Unit (DUWSS), WOP Unit (DUWSS), Marketing Section (DCS), Chief Financial Officer (CFO)
	16. Training	4	NRW Unit (DUWSS), Human Resource Unit (DSS)
	17. Institution	8	NRW Unit (DUWSS), Directorate Commercial Service (DCS), Metering Section (DCS), Human Resource Unit (DSS), Administration and Logistics Unit (DSS)
	18. Logistic and quality materials	2	Administration and Logistics Unit (DSS)

No* :Number of countermeasures



1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

- To make clear the contents and the bill of quantity of the priority of countermeasure, an inventory survey will be carried out. Concrete content of the survey was decided in January, 2017 and assumed an investigation was planned to start from February.
- Specification for inventory survey about facilities was prepared. As a result of the discussion on these contents (general schematic drawing of water reservoir tank, fact-finding of the stand pipe, sampling survey of customer meters) with WASAC in February, WASAC decided to implement by himself.
- However, apart from the following item c, the status of progress is considerably delayed due to personnel shortages, etc., so completion was not possible in 1st Phase. Therefore it was decided to deal with this by continuing to incorporate the details of this survey into the 5-year Action Plan for NRW Reduction.

  a. Review and Update of Schematic Transmission Pipeline Map and its Profile
  b. Review and Update of the Schematic Drawings of Reservoirs and Pumping Stations Interconnected by Transmission Pipes Above
  c. Survey of public taps and customer meters (Survey of Public Taps)
  d. Survey of public taps and customer meters (Sample Survey of Customer Meters)

1-5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.

Based on the Work Plan that was amended in April 2017, the report will be produced by the end of

August 2017.

1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

Based on the Work Plan that was amended in April 2017, the report will be produced by the end of August 2017.

1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.

Based on the Work Plan that was amended in April 2017, the report will be produced by the end of August 2017.

1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.

The budget for this financial year (July 2017 to June 2018) is scheduled to be added and amended with the approval by the WASAC Board of the 5-year Action Plan for NRW Reduction Report that will be prepared by the end of August 2017.

1-9 The management team prepares the 5-year Strategic Acton Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.

This will be produced by the end of August 2017 based on the framework for the 5-year Action Plan for NRW Reduction, produced in 1st Phase under “Activity 1-3”.

1-10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.

Scheduled to be held at the end of August 2017 when the Non-revenue Water Reduction 5-year Action Plan is prepared based on the Work Plan.

1-11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

This is scheduled to be implemented from May 2018 onwards in accordance with the progress of the pilot activities.

1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

The final review of the Non-revenue Water Reduction 5-year Action Plan is scheduled to be carried out from March 2018 onwards.

【Activities of Output 2】

: Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2-1 Training materials on NRW control are prepared.

A list of the training materials in each field relating to training of non-revenue water (text, presentation materials, etc.) in 1st Phase are shown in Table below.

Table 1.16　List of training materials

No.	Sector	Text & Manual	Contents	Source	Form
1	NRW Overview	NRW Reduction Concept Manual Attachment: -The Manager's Non-Revenue Water Handbook -The Manager's Non-Revenue Water Handbook for Africa	NRW Overview	JICA Team USAID, 2008 USAID, 2010	DOC DOC DOC
2	GIS	GIS　Procedure Guide	Data updating procedures	JICA Team	DOC
3	GIS	GIS Operational Manual	Data updating methods	JICA Team	DOC
4	Leakage detection	Composition of NRW	NRW Overview	JICA Team	DOC
5	Leakage detection	Handling and attention to use Ultrasonic and Electromagnetic Flow Meter	Theory and method of use of electromagnetic and ultrasonic flow meters	JICA Team	DOC
6	Leakage detection	Method and Classification of Leakage Detection	General overview of water leak detection	JICA Team	DOC
7	Leakage detection	Occurrence and transmission of leakage sound	Principles of occurrence of water leakage sound and survey methods	JICA Team USAID, 2008 USAID, 2010	DOC DOC DOC
8	Leakage detection	Analysis of acoustic (sound) investigating	Methods of analysis of acoustic surveys	JICA Team	DOC
9	Leakage detection	Manual for Leakage Detection	Manual of procedures for using water leak detectors	JICA Team	DOC
10	Leakage detection	Principle of correlation	Theory of leak noise correlators and survey methods	JICA Team	DOC
11	GIS	Folder Structure and how to open QGIS	Methods of information sharing using QGIS	JICA Team	PP
12	GIS	Utilization of Geographic Information System	Overview of GIS (for users)	JICA Team	PP
13	Hydraulic analysis	Introduction to Hydraulic Analysis 1	Basics of hydraulic analysis and methods of use	JICA Team	PP
14	Hydraulic analysis	Introduction to Hydraulic Analysis 2	Methods of use of EPANET	JICA Team	PP
15	Hydraulic analysis	Introduction to Hydraulic Analysis 3	Methods of use of Mike Urban	JICA Team	PP
16	Reduction plan	High Pressure Area by Branching from Transmission Pipeline and Pump	Methods of survey and analysis of the status in high water pressure areas	JICA Team	PP
17	Pipe repair	In-Room training & OJT of “Piping Works”	Appropriate construction management, earthworks, and recording methods	JICA Team	PP

No.	Sector	Text & Manual	Contents	Source	Form
18	Pipe repair	Pipe connection	Appropriate pipe connections, and issues and points of improvement	JICA Team	PP
19	Pipe repair	Pipe connection -Practice-	Methods of cutting and connecting distribution pipes, and points to note	JICA Team	PP
20	Water leakage detection	Leakage survey in Japan	Examples of water leak detection in Japan	JICA Team	PP
21	Water leakage detection	Equipment to be provided and utilization method	Theory and method of use of the water leak detectors to be provided	JICA Team	PP
22	Reduction plan	Topic-1_WASAC strategy (“To enhance further by adopting people-oriented approach”)	Insufficiency of sensor data, and the necessity for long-term planning		
23	Reduction plan	Topic-2_needs of quality data (Customer Data and Drawings)	The importance of GIS data, customer data, and drawing development	JICA Team	PP
24	Reduction plan	Topic-3_public taps (What’s the existing conditions?)	Issues regarding public water taps, and the necessity for surveys	JICA Team	PP
25	Reduction plan	Topic-4_large customers (Customer behavior largely affects WASAC)	The importance of management of large customers	JICA Team	PP
26	Reduction plan	Topic-5_asset management (What’s the criteria for replacement)	The status of aged pipes and materials, and the necessity for construction of DMAs and renewal in accordance with elevation	JICA Team	PP
27	Reduction plan	Topic-6_illegal water users (Legal or not?)	Analysis of the status of illegal connections using existing data, and why there are illegal connections	JICA Team	PP
28	Reduction plan	Topic-7_summary (What’s your priority measure?)	Proposal of NRW reduction methods and confirmation of order of priority	JICA Team	PP
29	Reduction plan	Topic-8_Five Year NRW Reduction Plan (‘“Approach and Procedures”)	Framework for NRW reduction proposed by the specialists	JICA Team	PP
30	Organization theory	Topic-9_Development of WASAC	Necessity of change of awareness and organizational improvements	JICA Team	PP
31	Organization theory	Topic-10_Rehabilitation or Extension	Necessity for countermeasures against water leakage and renewal	JICA Team	PP
32	NRW Overview	Topic-11_NRW in City_M_Indonesia	Examples of NRW reduction in Indonesia	JICA Team	PP
33	NRW Overview	Topic-12_Meter and Specification	Types, specifications, and accuracy of water meters	JICA Team	PP

(DOC: Document, PP: Power point)

Table 1.17　Register list

No.	Sector	Record	Contents	Source	Form
1	GIS	Check sheet for Customer Data Update	Check sheet for GIS customer data updating	JICA Team	EXL
2	GIS	Check sheet for Water Network Update	Check sheet for GIS pipeline and connection data updating	JICA Team	EXL1
3	Pipe repair	Template Daily Report (pipe works)	Register of the history of distribution pipe repairs	JICA Team	EXL

(EXL: Excel)

2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.

- The training materials for problem presentation on basic measures of NRW management were made, and a seminar was carried out for four times at every week in a project management meeting in October.
- The training was carried out based on "materials for problem presentation on basic measures of N RW management" mentioned above on November 1, 2016.

2-3　OJT is conducted on the updating of GIS data, using available GIS data base.

Following works were conducted.

- The technical training on GIS data update of C/P
- Rearranging and reexamination of a workflow affecting GIS update of customer and pipe network data update
- OJT on update of Branch boundary line data
- Activity that GIS data management
- The introduction of the Google Earth applied for GIS
- Introduction of the software of QGIS to 6 Kigali city branches and Google Earth (input to a PC) was performed to make the environment that WASAC can be shared the GIS data not only HQ but also branch offices and could watch freely, and to have operation and utilization of the GIS software fit the staffs other than the GIS team, and to smoothen a shift to future ArkGIS use.
- The reconfirmation of technology transfer contents and the introduction of the ArcGIS Geometric Network analysis (one of the pipe network analysis functions on ArcGIS) was carried out. Construction and editing of the pipe network model and analysis by this function can be carried out.
- The Manuals（GIS Procedure Guide and GIS Operation Manual: Data update on management for water network and customer information）were distributed to rerated section of HQ and 6 branch offices.

Table 1.18　Overview of GIS instruction activities

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey of status of GIS data development and operation, C/P's wishes, issues, etc.	From August to September, 2016	・Development of the WASAC GIS data by ESRI and software introduction were not completed. ・Software and data is saved in all the individual PCs. ・Skill in the use of the ArcGIS software is comparatively high, but preparation of drawings using GIS has not been implemented. ・Skills in data analysis using software other than ArcGIS, such as Excel, etc., is low. ・As an organization, use of GIS has not been achieved.	-
Activity 1	Activities relating to updating GIS data (customer and pipe network data, new customers)	From September to October, 2016	Technical support and consulting was provided for continuous updating of data mainly by the WASAC GIS team, effectively utilizing the GIS data prepared by ESRI and the GIS software.	The C/P has understood the skills and techniques necessary for updating GIS data. Activities will be implemented after delivery of the outputs.
Activity 2	GIS support relating to the hydraulic isolation plan for the 4 branches within Kigali city	From September to October, 2016	For 4 of the 6 branches within Kigali city, excluding the 2 branches associated with the SUSWAS project, GIS support was provided for the investigation and identification of the flow meter installation locations for hydraulic isolation.	The managers can carry out investigations and explanations together with the C/P from the point of view of GIS.
Activity 3	Activities relating to utilization and sharing of GIS data	From September to October, 2016	In order to promote the utilization of GIS data in the whole WASAC organization, GIS data sharing was carried out by QGIS for the 6 branches within Kigali city.	The branch staff has understood the methods of sharing information using QGIS.
Activity 4	Practical technology transfer relating to ArcGIS layouts and data analysis	From September to November, 2016	・Instruction was provided on the standard layout techniques together with the method of preparation of "data-driven pages" which was not known by the GIS team. ・Instruction was provided on the construction of "geometric networks" and analysis methods for analyzing pipeline networks using ArcGIS.	Applied techniques regarding layout and data analysis have been understood. Activities will be implemented after delivery of the outputs.

2-4　OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

Collection of hydraulic analysis-related data, and, the lectures and a seminar of the hydraulic analysis and water pressure management analysis were performed six times for November 8 from September 29

for a GIS team.

- The training of general theory of the hydraulic analysis
- The practice by application EPANET of the hydraulic analysis
- Construction of the use environment of hydraulic analysis software MikeUrban and the training about the usage of it
- Hydraulic analysis of the pilot area

Table 1.19 Outline of training activities for hydraulic analysis and pressure management

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey on WASAC's problems, etc. related to hydraulic analysis	From August to September, 2016	- At present, there is not sufficient GIS data of ESRI, which serves as the basic data for carrying out hydraulic analysis. Modeling has not been completed. - WASAC, having no track record of hydraulic analysis, does not sufficiently understand the implementation of hydraulic analysis and has not created an analysis work flow. - WASAC does not have a vision for "what it can and must do" with hydraulic analysis. - The hydraulic analysis application, Mike Urban, is provided as an add-on for the GIS application. Therefore, WASAC hydraulic analysis is to be conducted by two of the persons in GIS.	-
Activity 1	Training on understanding and implementation of hydraulic analysis	September, 2016	- Purpose of hydraulic analysis - Basics of hydraulics - Hazen-Williams formula	The basic theory has been understood. The actual methods of utilization and the application of these practical methods is insufficient.
Activity 2	Handling of existing data (GIS and water consumptions) required for hydraulic analysis	From September to October, 2016	- Flow and handling of data in WASAC - Reliability check for data quality and hydraulic analysis results	The basic methods of handling have been understood. The actual methods of utilization and the application of these practical methods is insufficient.
Activity 3	OJT on hydraulic analysis modeling and software usage	From October to November, 2016	- Use of EPANET - Use of Mike Urban	The method of using the software has been understood. Activities will be implemented after delivery of results.

2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

One of the high-priority issues in the efforts for NRW control is the management capacity for water volumes and pressures. Specifically, the training must be provided to (1) learn the importance of the bulk meter management regarding the System Input Volume and (2) enhance the management capacity for accurate measuring of the Authorized Consumption.

On-the-job training to measure the sectional flow rate of transmission pipeline for identification of the amount of water leak was conducted. Discharge at the water source plants, aqueducts, bridge-attached pipes and water reservoirs was measured through the training.

Since the proposed equipment procured by JICA for leak detection could not be delivered before the training period in 1st Phase, the training was conducted by using only rented equipment of ultrasonic flow meter, headphone-type leak detector, and electronic leak noise detector.

Table 1.20 Outline of training activities for "Leak detection"

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey on WASAC's problems, etc. related to leak detection	March, 2017	- Has not conducted activities for leak detection yet. - Owns but has not used equipment for leak detection. - Has not conducted survey on the amount of water leak nor identified the status quo. - Lacks the concepts of water volume management and pressure management in the NRW control.	-
Activity 1	OJT and OFF-JT on pressures, flow rates, and leak measurement	From March to May, 2017	- Training on the survey method for water leakage (degree of deterioration) based on measurement and metering in transmission pipe system and distribution pipe network (pilot area) - Training on the operation methods for ultrasonic flow meters and pressure gauges - Theories of items and the analysis method for survey results	The objectives, theory, implementation procedures, measurement methods, and analysis methods have been understood.
Activity 2	OJT and OFF-JT on leak detection technologies	From April to May, 2017	- Training on leak detection techniques in Pilot Area 1 - Training on house-to-house survey techniques in Pilot Area 1 - Headphone-type leak detector and electronic noise detector - Theories of items and analysis method for survey results (Training continued in 2nd Phase)	The objectives, theory, implementation procedures, measurement methods, and analysis methods have been understood.
Activity 3	OJT and OFF-JT on monitoring and data analysis	From April to May, 2017	- Training on flow behavior monitoring techniques in Pilot Area 1 - Training on water consumptions, system input, and minimum flow rate at night in Pilot Area 1	The objectives, implementation procedures and measurement methods have been

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
			(Training continued in 2nd Phase)	understood.
Activity 4	Analysis methods for NRW components	-	(Training in 2nd Phase)	-
Activity 5	Check and Repair of existing equipment	From March to May, 2017	- Repair and test usage of equipment owned by WASAC (leak detectors, data loggers, headphone-type leak detectors, leak noise correlators, and ultrasonic flow meters) - (Training on usage in 2nd Phase)	The equipment owned has been repaired.

2-6　In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

For the training, the status of repair of leaking water pipes and the status of connection of new pipe connections were confirmed in 6 branches in Kigali city and 1 branch outside Kigali city, and the organization, personnel, and materials and equipment were confirmed, issues were identified as shown in Table below, and the instruction was provided with regard to these issues.

In 2nd Phase when the pilot project will be implemented, more specific instruction will be provided on the contents of the instruction given in 1st Phase. Monitoring will be carried out to determine whether or not the details of the instruction carried out in 1st Phase and the records are being appropriately utilized.

Also, it is considered that some of the items among the issues identified should be incorporated into the 5-year Action Plan for NRW Reduction, such as (1) strengthening the construction supervision system, (2) improvement in pipe repair skills, and (3) strengthening of materials stock, transport vehicles, etc. However for matters such as (1) technical standards and specifications, (2) construction and materials standards, (3) construction of detailed pipe network drawings, etc., countermeasures from a long-term viewpoint are necessary.

The C/P for this field were members of staff of the branches, so it was decided to improve the main issues facing WASAC (construction methods and use of appropriate equipment and materials) by providing instruction through site visits and observation, and the methods of use of the procured equipment in seminars, etc. The necessity of improvement was sufficiently understood through this instruction, and its practical application in earthworks and new connections has already commenced. Entering the checksheets produced is being implemented, so it is important to carry out monitoring and evaluation of the status of implementation. Also, WASAC has started to examine the purchase of some of the new equipment that is necessary for the improvements. Other than these, regarding the necessary staff increases, vehicles, heavy machinery, etc., they are stated in the framework for incorporation into the 5-year Action Plan for NRW Reduction, and investigation of the appropriate quantities, etc., will be carried out in 2nd Phase.

Table 1.21　Overview of training activities

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey of issues, etc., regarding repair of leaking water pipes and installation of water supply equipment by WASAC (6 branches in Kigali city)	January 2017 April 2017	・Standards and specifications have not been developed for installation of pipes, and inappropriate construction is carried out based on empirical rules. ・Management drawings are not prepared and stored, so information cannot be shared. ・There is insufficient understanding of backfilling earthworks, so construction is being carried out that causes damage to pipes. ・The construction tools, vehicles, etc. at branch level are absolutely insufficient. ・The methods of connecting pipes and bringing out water hydrants are inappropriate. ・Checking of pressure resistance is not carried out after connecting. ・Supervision of construction by private contractors is not carried out.	-
Activity 1	Preparation of training materials in accordance with the issues	From February to March, 2017 May, 2017	・Earthwork techniques ・Material selection and pipe cutting , boring and connection methods ・Construction management such as safety, quality (inspection), schedule control, records, etc. ・Register of the history of repairs	The trainees have carried out seminars using the prepared training materials
Activity 2	Indoor training and OJT using the training materials	From March to May, 2017	・Operation control and technology, instruction regarding registers and records (indoors) ・Instruction on improvements in pipe repair work at the branches (OJT) ・Methods of handling soils (OJT) ・Welding of polyethylene pipes (OJT) ・Safety measures (OJT)	The managers from the 6 branches have understood the importance of construction management and records, and the points of improvement regarding distribution pipe connections and repairs.
Activity 3	Indoor training and OJT using the WASAC training yard	May, 2017	・Development, maintenance and repair of the training yard ・Prevention of leaks, pipe connections, laying pipes (indoors) ・Pipe selection methods, calculation methods, utilization of drawings (indoors) ・Pipe cutting, welding, drilling, and connection (OJT) ・Formulation of work improvement plans by the branch managers	The managers of the 6 branches have understood the methods of using the equipment, appropriate pipe connections and repair methods, and have summarized the points of improvement. (Implementation on site will be in 2nd Phase)

2-7　In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

Instruction in 'Meter reading, Invoicing of charges, and Customer service' was commenced after confirming the consistency of the customer data, charge collection data, and GIS customer data, and instruction was provided for the issues identified from surveys on site and interviews with branch heads, etc., as shown in Table below. On the other hand the departments involved in this field are diverse, so instruction was provided individually to key persons in each department, such as GIS personnel, Commercial Services, etc., and regular weekly meetings were held led by the NRW Section, where the various issues and countermeasures were discussed. In addition, for more than about 100 members of staff (branch heads, persons responsible for water operations, pipeline engineers, meter readers) of the 6 branches within Kigali city, which is the frontline of activities in this field, a seminar was held over 3 days from the 9th to the 11th May 2017 on the issues facing WASAC and the methods necessary to deal with these, using lecturers (key persons) selected from Commercial Services. In this seminar, each of the managers of the branches prepared an improvement activity plan by themselves describing what needed to be done in the future, as part of the raising of awareness. They will carry out monitoring during the construction activities of 2nd Phase to confirm that the improvement activities are being implemented.

Table 1.22　Overview of training activities

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey of issues, etc., in WASAC regarding meter reading, invoicing of charges, and customer service	From August to December, 2016	・There are no standards or plans for installation and renewal of water meters. ・The status of defective water meters has not been determined, payment data has not been analyzed, and the existence of fault data has not been determined. ・Management is insufficient, so there are many discarded public water hydrants. ・Data possessed by Customer Service is not shared with the NRW Section. ・The GIS customer data and the Commercial Services customer data are not linked, and there is a discrepancy of more than 20%.	-
Activity 1	Identification of data shortages	From January to May, 2017	・Implementation of survey of status of public water hydrants ・Customer analysis of large-scale customers (2nd Phase) ・Recommendations regarding illegal connections	Implementation schedule to be continued into 2nd Phase.
Activity 2	Instruction on methods of analysis of	From November to December,	・Methods of analysis of customer data using Excel ・Analysis of fault data	The methods of analysis have been understood, and the trainees of WASAC

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
	existing data	2016		Head office have held seminars for branch employees.
Activity 3	Instruction regarding checking of meters	From January to May, 2017	・General methods of checking meters ・Criteria for judging defective customer meters ・Awareness workshop for meter readers (preparation of activity plan)	The trainees of WASAC Head offices have held seminars for branch employees, and the points of improvement have been summarized.
Activity 4	Instruction regarding new connections	From January to May, 2017	・Types of water meters and specifications for water supply hydrants ・Meters and installation methods ・Awareness workshop for water distribution operators and pipe construction (preparation of activity plan)	The trainees from WASAC Headquarters have held seminars for branch employees, and the points of improvement have been summarized.
Activity 5	Instruction regarding customer service	From January to May, 2017	・Overview of customer service ・Awareness workshop for branch heads relating to checking of meters and new connections	The trainees from WASAC Headquarters have held seminars for branch employees, and the points of improvement have been summarized.
Activity 6	Construction of implementation system within branches for pilot activities	-	(Specific formulation in 2nd Phase in accordance with the pilot activity plan)	-

2-8　Training materials on NRW are reviewed and updated.

Updating will be carried out through implementation of the pilot project of Output 3.

2-9　Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

This is scheduled to be implemented from May 2018 onward, based on the work plan.

【Activities of Output 3】

: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

3-1　An action team is organized to conduct NRW reduction measures at Pilot Area 1.

- The member of the action team is appointed formally in August by CEO, and formation is finished in August 2016.

3-2 The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.

- Selection of two pilot areas (Area 1: Kadobogo (Kiyovu) Kacyiru Branch Area 2: Ruyenzi (Runda) Nyarugenge Branch) from the proposed candidate sites in September 2016.
- Information dada collection of Kigali city and the two pilot areas in September 2016
- Information data update of pilot areas such as population and number of customers

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1.

- A work plan of pilot project for area1 was prepared.
- Preparation of facilities plan for the establishment of pilot area such as location of inlet chamber and design them including requires equipment such as flowmeter, pressure gauge and valves in September
- The detailed design of the chamber at the inlet (flowmeter setting position) was made in September, and trial excavation was conducted for confirm the number of the existing pipe, laying position, depth, type, diameter, and performed final decision of the structure in October.
- The contents, specification and quantity of the equipment to be installed in the chamber were clarified in October.

3-4 The action team hydraulically isolates Pilot Area 1, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1.

Procurement of Equipments

- Contents of procurement equipment (flowmeter, pressure gauge, valve, customer meter etc.) were confirmed and specification and BoQ were decided in October.
- The procurement preparations such as marketing researches, contract documents, supplier list for competition of quotation were performed in September..
- Notice for competition of quotation was made October 14, and as a result of evaluation of the documents submitted, the contract with a procurement supplier on November 8. The delivery of the

equipment is scheduled in March.

Construction of Chambers

- Design of four chambers to be installed inlets of the pilot area was performed for the price competition in September.
- Notice of the price competition to the contractors was made on December 8, 2016 for submission of the quotation on January 27, 2017. As the result of evaluation of it, contract was agreed on February 15, 2017.
- Construction work has completed in May 25, 2017.
- The additional investigation for separation of the tertiary pipe in the Kadobogo pilot area was performed. Isolation work was performed by WASAC.

3-5 The action team establishes the baseline NRW rate of Pilot Area 1.

The implementation in July 2017 or later is planned based on the work plan.

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.

The implementation in July 2017 or later is planned based on the work plan.

3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.

The implementation in January 2018 or later is planned based on the work plan.

3-8 The action team conducts measures for reducing surface leakage (visible leakage).

The implementation in January 2018 or later is planned based on the work plan

3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

The implementation in March 2018 or later is planned based on the work plan.

3-10 The action team conducts measures for reducing underground leakage (invisible leakage).

The implementation in March 2018 or later is planned based on the work plan.

3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

The implementation in May 2018 or later is planned based on the work plan.

3-12 The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.

The implementation in May 2018 or later is planned based on the work plan.

3-13 The action team summaries activities and results from Activities 3-1 to 3-12, prepares the

completion report on the pilot project for Pilot Area 1, and submits it to the management team.

The implementation in May 2018 or later is planned based on the work plan.

3-14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.

The implementation in May 2018 or later is planned based on the work plan.

3-15 Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.

The implementation in June 2018 or later is planned based on the work plan.

3-16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

The implementation in July 2018 or later is planned based on the work plan.

【Activities of Output 4】

: 4 branches in Kigali establish the system to measure NRW rates accurately.

4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

- About 4 branch isolation, the GIS team and the Branch Offices made opinion adjustment with advice of JICA expert, site investigation in order to decide the boundary lines in October, 2016.
- Because it was revealed that the movement between branches of the customer registration was necessary about the decision of the boundary line, it was decided to adjust it after boundary line decision.
- Four branch separation boundary lines were established by the end of September, 2016, But it was non-start about movement of customer registration.
- A GIS team clarified re-enrollment about the movement of customer registration (1712 as of September 2016)

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

- Flowmeter setting positions for isolation of 4 branches were examined on the GIS map jointly with NRW team and GIS team in a project progress meeting of October 7.
- After the position decision on the quantity, individual spot investigation was carried out by JICA

team and WASAC team to confirm condition of existing distribution pipes. Trial excavation was conducted for 18 places.

- The joint meeting of the NRW and GIS team was held in order to settle site setting position of flowmeter on October 31.
- The technical specifications of the equipments such as electromagnetic flowmeter, mechanical flowmeter, pressure gauge, valves, data loggers and server hardware etc. for the establishment of monitoring system was prepared by the end of November.
- Technical specification and Bill of Quantity for the tender were submitted to the JICA office on December 9.

4-3 Electromagnetic flowmeters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.

Construction of Chambers

- 23 chambers to be installed in the network were designed for the tender in November 2016.
- Notice of the price competition to the contractors for construction of chambers was made on December 8, 2016 for submission of the tender on January 27, 2017.　As the result of evaluation of it, contract was agreed on February 15, 2017.
- Procurement of the equipment to be installed within the concrete chambers decided upon in 'Activity 4.2' is being carried out by the JICA office. The tender notice was published on May 26, 2017, the tender explanation meeting was held on May 30, and a supplier within Rwanda is scheduled to be selected by July 21.
- The concrete chambers in which this equipment will be installed are currently under construction by outsourcing to a local company. Concrete chambers are being constructed at 23 locations, of which construction has been completed at 11 locations in 1st Phase, and construction work will continue at the remaining 12 locations in 2nd Phase. However, delivery of the equipment is likely to be on or after November 2017 in 2nd Phase. After the equipment has been procured, it will be installed by WASAC, under the supervision of the specialists.

4-4　System input to each of 4 branches is measured.

The implementation in January 2018 or later is planned based on the work plan.

4-5　Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.

The implementation in January 2018 or later is planned based on the work plan.

1-3 Achievement of Output

Achievement status of the Project outputs is observed according to the PDM indicators as the table below indicates:

Table 1.23 Achievement of Outputs

Outputs	Objectively Verifiable Indicators	Status of the Achievement
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	・The relevant information are being collected from existing data and documents.(GIS data, Customer data, PIP: Performance Improvement Programme, NRW Action Plan, Questionnaire survey for 20 branches） ・Site visit survey for up-countries Branch offices) was conducted to get fact-findings of WASAC's NRW reduction activity for the cause analysis of NRW. ・Inventory survey is being conducted by WASAC ・Since not enough time was secured to make action plans in the 1st Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in 2nd Phase together with WASAC management team and action team. ・Framework of the Action Plan was finalized in the seminar held on May 29, 2017 by WASAC management team and action team. ・Detail sub-actions of counter measures, working schedule, Bill of Quantity of the activities at each responsible sections of Head Office and 20 Branch Offices will be listed up as Action Plan for 5-year separately, in June and July 2017. ・Budged for Action Plan will be estimated in August. ・Action Plan will be finalized and seminar to share the result will be held at the end of August 2017. ・Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than XX number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	・Training on NRW management was conducted ・OJT was conducted on the updating of GIS data base ・OJT was conducted on hydraulic analysis, and pressure management ・In-room training and OJT on leak detection was conducted. Since the proposed equipments for leak detection were not delivered before the timing of the training, only limited rental equipments were used. Another training is planned in the 2nd Phase through the Pilot Project. ・In-room training and OJT on repairing leaking pipes and installing service connection was conducted and another training is planned in the 2nd Phase through the Pilot Project. The materials and equipments to be used for the training were procured. ・In-room training and OJT on meter reading, billing, customer services will be conducted in the 2nd Phase through the Pilot Project. ・The capacity assessment of C/Ps and related sections in Head Office and 6 Branche Offices in Kigali city will be carried out through the activities in the 2nd Phase. So, the baseline survey and end line survey for capacity assessment will be carried out in the 2nd Phase. ・Draft indicators for Output 2-1 will be proposed by the Expert Team during the third Management Team meeting scheduled on August ** 2017 and will be accepted in the second SC scheduled beginning of September 2017. ・Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.

3	WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.) 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	・Two pilot areas (Area 1: Kadobogo, Kacyiru Branch, Area 2: Ruyenzi, New Nyarugenge Branch) were selected. ・The preparation work in order to setting up above two pilot areas (DMAs) was conducted such as procurement of the equipments and construction of chambers for inflow measurement, separation of tertiary distribution pipes for isolation of the area and installation of valves in the network. ・Implementation of the OJT activity for Area 1 was planned. ・The baseline survey of pilot areas will be implemented for NRW reduction. ・Draft indicators for Output 3-1 will be proposed by the Expert Team during the third Management Team meeting scheduled on August ** 2017 and will be accepted in the second SC scheduled beginning of September 2017. ・Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.
4	4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	・Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided.・Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey. ・Detailed design was done for preparation of technical specifications of the equipment of a monitoring system. ・The chambers were designed and construction work has been started from March 2017. The 11 chambers were constructed in 1st Phase and construction of the remaining 12 chambers are in process.・The tender procedure on procurement of the equipment of monitoring system has been started from May 26, 2017. It is supposed the equipment will arrive in November 2017.・Afterward, installation of the equipment will be carried out by WASAC as the training under instruction of JICA Expert. ・Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.

1-4 Achievement of the Project Purpose

Project Purpose

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.

Objectively Verifiable Indicators

1. 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.
2. Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC.
3. The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction

Means of Verification

1. 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure
2. Annual action plan of WASAC
3. Budget of WASAC

5-year Strategic Action Plan for NRW reduction is scheduled to elaborate at the end of August 2017. Afterward, the Action Plan should be approved by the Minister of Infrastructure. Action Plan of 6 branches in Kigali City should be reflected in annual action plan of WASAC. The budget for implementing Action Plan of 6 branches in Kigali City should be approved. These conditions of the Indicators will be achievement after elaboration of 5-year Strategic Action Plan, that is after September 2017.

1-5 Changes of Risks and Actions for Mitigation

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

(1) Pre-Conditions

Table 1.24 Action for Mitigation on Pre-Condition

PDM Pre-Conditions	Curent Situation	Action for Mitigation
1 GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.	1-1 By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017. Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule. In the beginning of September, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikUrban was made by Esri in the end of October.	

(2) Important Assumption on Proceeding Assumptions (from Outputs to Project Purpose)

Table 1.25 Action for Mitigation on Important Assumption (from Outputs to Project Purpose)

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The non-revenue water section at WASAC is not subject to large scale reorganization.	1-1 Structure of WASAC was devised on March 2, 2017, but does not lead to the enforcement as of June 2017. On the project, it is thought that there is not the substantial influence. Movement Planning Unit of UWSS to the direct control of CEO, movement of the GIS section to under the WOS unit.	
2 WASAC staff do not resign after training by the Project.	1-2 Not applicable	
3 Large scale natural disaster dose not occur.	1-3 Not applicable	

(3) Important Assumption on Proceeding Assumptions to Overall Goal

Table1.26 Action for Mitigation on Importance Assumptions (from Project Purpose to Overall Goal)

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The Government policy on NRW remains as highly prioritized.	1-1 Not applicable	

1-6 Progress of Actions undertaken by JICA

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment is in process. These are expected to be procured by July 2017.
- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is in process. These are expected to be procured by November 2017.

1-7 Progress of Actions undertaken by Rwanda side

1) Completed

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Joint visit JICA-WASAC of WASAC's upcountry branches.
- Training in Japan

2) In progress

- Inventory survey is caring out by WASAC team.
- Preparation of 5-year Strategic Action Plan for NRW reduction.
- Leakage detection work of service connection of customer meter in Pilot Area 1.

1-8 Progress of Environmental and Social Considerations (if applicable)

No remarkable progress and consideration have been seen.

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

No remarkable progress and consideration have been seen.

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

SUSWAS Project

2　Delay of Work Schedule and/or Problems (if any)

2-1 Detail

1）Delay of preparation of 5-year Strategic Action Plan for NRW reduction (Output 1)

Since not enough time was secured to make action plans in the 1st Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in 2nd Phase together with WASAC management team and action team.

It needs to be elaborate on to produce a more tangible and practical institutional framework. The role and responsibilities of the management team in the framework for the NRW reduction plan should be confirmed.

In the management team meeting held on March 15, 2017, it was decided that the preparation work of Action Plan continues into 2nd Phase of the project until the end of August 2017 and the work method. The current situation of NRW activities, causes and countermeasures are discussed through the series of workshops held from March to May of 2017. As a result, the framework of the Action Plan was finalized in the seminar held on May 29, 2017 by WASAC management team and action team.

Detail sub-actions of counter measures, working schedule, Bill of Quantity of the activities at each responsible sections of Head Office and 20 Branch Offices were listed up as tangible Action Plan for 5-year, separately, in June and July 2017.

Budged for Action Plan will be estimated in August. Action Plan will be finalized and seminar to share the result will be held at the end of August 2017. The Action Plan should be approved by Board of Directors of WASAC and MININFRA .

2）Delay of Inventory Survey (Output 1)

Inventory survey was scheduled to be implemented by local subcontracting on the JICA expart’s side as

follows. However as a result of a strong wish by WASAC, it was decided that it will be carried out by WASAC, and the JICA expart will provide support for this.

However, apart from the following item c, the status of progress is considerably delayed due to personnel shortages, etc., so completion was not possible in 1st Phase. Therefore it was decided to deal with this by continuing to incorporate the details of this survey into the 5-year Action Plan for NRW Reduction.

a. Review and Update of Schematic Transmission Pipeline Map and its Profile
b. Review and Update of the Schematic Drawings of Reservoirs and Pumping Stations Interconnected by Transmission Pipes Above
c. Survey of public taps and customer meters (Survey of Public Taps)
d. Survey of public taps and customer meters (Sample Survey of Customer Meters)

3）Procurement of the equipment for water leak detectors　(Output 2)

Since the proposed equipment procured by JICA for leak detection could not be delivered before the training period in 1st Phase, the training was conducted by using only rented equipment of ultrasonic flow meter, headphone-type leak detector, and electronic leak noise detector.

The equipment will be expected to deliver in July 2017.

4）Construction of the chambers for installation of the equipment for monitoring system (Output 4)

The chambers were designed and construction work has been started from March 2017. The 11 chambers were constructed in 1st Phase and construction of the remaining 12 chambers are in process. The all works will be expected to complete in August 2017.

5）Procurement and installation schedule of the equipment for monitoring system (Output 4)

The tender procedure on procurement of the equipment of monitoring system has been started from May 26, 2017.　It is supposed the equipment will arrive in November 2017.　Afterward, installation of the equipment will be carried out by WASAC as the training under instruction of JICA Expert.

6) Indicator of Project Design Matrix (PDM)

Draft indicators for Overall Goal, Output 2-1 and Output 3-1 of the PDM will be proposed during the third Management Team meeting scheduled in August 2017 and will be accepted in the second SC scheduled in September 2017.

Table 1.27　PDM of This Project

Output	Objectively Verifiable Indicators
【Overall Goal】	NRW rate of Kigali city（year 2022 xx %）(to be confirmed during the project)
【Outputs】	
Output 2.	1：More than XX number of trainees receive training.
Output 3.	1：NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.)

7) Capacity Assessment of the Project

The capacity assessment of C/Ps and related sections in Head Office and 6 Branche Offices in Kigali city will be carried out through the activities in the 2nd Phase. So, the baseline survey and end line survey for capacity assessment will be carried out in the 2nd Phase.

3　Modification of the Project Implementation Plan

3-1 PO

As a major modification, the timeline of Activity 1.4-1.10 and Activity 4.3 were shifted to the beginning of the 2nd phase from the 1st phase. This modification was reflected as PO.

Activity 4.4 and 4.5 will be started from March 2018.

3-2 Other modifications on detailed implementation plan

No major modification was made.

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4. Preparation of Rwanda Side toward after completion of the Project

Not applicable.

II. Project Monitoring Sheet I & II

As attached.

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 3

Implementing Agency: WASAC

Dated July 31, 2017

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2019/6/30

Project Site: 4 Branches in Kigali city(Kacyiru, Nyamirambo, Gikondo, Nyar Model Site:

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city（year 2022 xx %）(to be confirmed during the project)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	N/A	
Project Purpose WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The non-revenue water section at WASAC is not subject to large scale reorganization. WASAC staff do not resign after training by the Project. Large scale natural disaster dose not occur.	Structure of WASAC was devised on March 2, 2017, but does not lead to the enforcement as of June 2017. On the project, it is thought that there is not the substantial influence. Movement Planning Unit of UWSS to the direct control of CEO, movement of the GIS section to under the WOS unit.	
Outputs 1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Proiect. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project		・ The relevant information are being collected from existing data and documents.(GIS data, Customer data, PIP: Performance Improvement Programme, NRW Action Plan, Questionnaire survey for 20 branches) ・ Site visit survey for up-countries Branch offices) was conducted to get fact-findings of WASAC's NRW reduction activity for the cause analysis of NRW. ・ Inventory survey is being conducted by WASAC ・ Since not enough time was secured to make action plans in the 1st Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in Phase 2 together with WASAC management team and action team. ・ Framework of the Action Plan was finalized in the seminar held on May 29, 2017 by WASAC management team and action team. ・ Detail sub-actions of counter measures, working schedule, Bill of Quantity of the activities at each responsible sections of Head Office and 20 Branch Offices will be listed up as Action Plan for 5-year separately, in June and July 2017. ・ Budged for Action Plan will be estimated in August. ・ Action Plan will be finalized and seminar to share the result will be held at the end of August 2017. ・ Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than XX number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		・Training on NRW management was conducted ・OJT was conducted on the updating of GIS data base ・OJT was conducted on hydraulic analysis, and pressure management ・In-room training and OJT on leak detection was conducted. Since the proposed equipments for leak detection were not delivered before the timing of the training, only limited rental equipments were used. Another training is planed in the 2nd Phase through the Pilot Project. ・In-room training and OJT on repairing leaking pipes and installing service connection was conducted and another training is planed in the 2nd Phase through the Pilot Project. The materials and equipments to be used for the training were procured. ・In-room training and OJT on meter reading, billing, customer services will be conducted in the 2nd Phase through the Pilot Project. ・The capacity assessment of C/Ps and related sections in Head Office and 6 Branche Offices in Kigali city will be carried out through the activities in the 2nd Phase. So, the baseline survey and end line survey for capacity assessment will be carried out in the 2nd Phase. ・Draft indicators for Output 2-1 will be proposed by the Expert Team during the third Management Team meeting scheduled on August ** 2017 and will be accepted in the second SC scheduled beginning of September 2017. ・Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.	
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.) 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		・Two pilot areas (Area 1: Kadobogo, Kacyiru Branch, Area 2: Ruyenzi, New Nyarugenge Branch) were selected. ・The preparation work in order to setting up above two pilot areas (DMAs) was conducted such as procurement of the equipments and construction of chambers for inflow measurement, separation of tertiary distribution pipes for isolation of the area and installation of valves in the network. ・Implementation of the OJT activity for Area 1 was planned. ・The baseline survey of pilot areas will be implemented for NRW reduction. ・Draft indicators for Output 3-1 will be proposed by the Expert Team during the third Management Team meeting scheduled on August ** 2017 and will be accepted in the second SC scheduled beginning of September 2017. ・Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.	
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		・Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided. ・Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey. ・Detailed design was done for preparation of technical specifications of the equipment of a monitoring system. ・The chambers were designed and construction work has been started from March 2017. The 11 chambers were constructed in Phase 1 and construction of the remaining 12 chambers are in process. ・The tender procedure on procurement of the equipment of monitoring system has been started from May 26, 2017. It is supposed the equipment will arrive in November 2017. ・Afterward, installation of the equipment will be carried out by WASAC as the training under instruction of JICA Expert. ・Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.	

Activities		Inputs				Pre-Conditions
		The Japanese Side		The Rwanda Side		
1-1	A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.					
1-2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.	1	Experts Dispatch	1	Counterpart	
1-3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.		Chief Adviser／Non-Revenue Water management		Project Director	
1-4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.		Non-Revenue Water reduction planning		Project Manager	
1-5	Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.		GIS		Management team members	
1-6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.		Hydraulic analysis		Action team members	・GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.
1-7	The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.		Leak detection		Other counterparts	
1-8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.		Pipe repairing and service pipe connection			
1-9	The management team prepares the 5-year Strategic Acton Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.		ICT			
1-10	The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.					
1-11	The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2	Training	2	Facilities	**<Issues and countermeasures>**
1-12	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.		Training in Japan		Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017. Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule. In the beginning of September, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikUrban was made by Esri in the end of October.
2-1	Training materials on NRW control are prepared.		Training in the 3rd country		Training room with the capacity of about 20 persons	
2-2	Training on NRW management is conducted for the management team and WASAC management as necessary.				Space for training on pipe repair and service pipe connection(40㎡)	
2-3	OJT is conducted on the updating of GIS data, using available GIS data base.	3	Equipment provision		Store house for equipment	
2-4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models		Leak detection equipment			
2-5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment		Ultrasonic flow meter with data logger	3	Local cost	
2-6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted		Gate valve, flow meter, and customer meter for Pilot Project		Cost for administering the Project (utilities for experts offices, internet services)	
2-7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.		Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigal		Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8	Training materials on NRW are reviewed and updated.		Equipment for training on pipe repair and service pipe connection		Cost for operation and maintenance of project equipment	
2-9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.		Mobile GPS		Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1	An action team is organized to conduct NRW reduction measures at Pilot Area 1.		Vehicles for Japanese experts			
3-2	The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.					
3-3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1.					
3-4	The action team hydraulically isolates Pilot Area 1, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1.					
3-5	The action team establishes the baseline NRW rate of Pilot Area 1.					
3-6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.					
3-7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.					
3-8	The action team conducts measures for reducing surface leakage (visible leakage).					
3-9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.					
3-10	The action team conducts measures for reducing underground leakage (invisible leakage).					
3-11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.					
3-12	The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.					
3-13	The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.					
3-14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.					
3-15	Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.					
3-16	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.					
4-1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.					
4-2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.					
4-3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.					
4-4	System input to each of 4 branches is measured					
4-5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.					

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 3
Dated July 31, 2017

Project Title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs	Plan/Actual	1st Year (16/17) I	1st Year (16/17) II	1st Year (16/17) III	1st Year (16/17) IV	2nd Year (17/18) I	2nd Year (17/18) II	2nd Year (17/18) III	2nd Year (17/18) IV	3rd Year (18/19) I	3rd Year (18/19) II	3rd Year (18/19) III	3rd Year (18/19) IV	Remarks	Monitoring: Issue	Monitoring: Solution
Expert		8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6							
Chief Adviser/Non-Revenue Water Management	Plan															
	Actual															
Adviser/Non-Revenue Water Management	Plan															
	Actual															
NRW Reduction Plan 1 (1)	Plan															
	Actual															
NRW Reduction Plan 1 (2)	Plan															
	Actual															
NRW Reduction Plan 2 (1)	Plan															
	Actual															
NRW Reduction Plan 2 (2)	Plan															
	Actual															
Geographic Information System: GIS	Plan															
	Actual															
Hydraulic Analysis	Plan															
	Actual															
Leak Detection	Plan															
	Actual															
Pipe Repairing and Service Connection (1)	Plan															
	Actual															
Pipe Repairing and Service Connection (2)	Plan															
	Actual															
Information and Communication Technology: ICT	Plan															
	Actual															
Equipment																handing over to WASAC
Lot 1: Equipment for training on pipe repair and service pipe connection	Plan													accepted in May 2017	handing over to WASAC	not yet
	Actual															
Lot 2: Pilot Projects (Customer Meter)	Plan													accepted in March 2017		not yet
	Actual															
Lot 3: Pilot Projects (Gate valve, flow meter, and customer meter)	Plan													accepted in May 2017		not yet
	Actual															
Lot 4: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)	Plan													expected to provide in November 2017	Tendering procedure is still in process	not yet
	Actual															
Lot 5: Vehicles for Japanese experts	Plan													provided in January 2017		not yet
	Actual															
Lot 6: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc)	Plan													expected to provide in July 2017	Procurement procedure is in process	not yet
	Actual															
Lot 7: Mobile GPS, Potable Test meter etc	Plan													accepted in October 2016		not yet
	Actual															
Training in Japan																
25 persons will be trained in Japan (5, 10, 10)	Plan															
	Actual															
In-country/Third country Training																
	Plan															
	Actual															

Activities / Sub-Activities	Plan/Actual	1st Year (16/17) I	1st Year (16/17) II	1st Year (16/17) III	1st Year (16/17) IV	2nd Year (17/18) I	2nd Year (17/18) II	2nd Year (17/18) III	2nd Year (17/18) IV	3rd Year (18/19) I	3rd Year (18/19) II	3rd Year (18/19) III	3rd Year (18/19) IV	Responsible Organization: Japan	Responsible Organization: RWANDA	Achievements	Issue & Countermeasures
Output 1: Planning capacity of NRW reduction of WASAC is enhanced.		8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6								
1.1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.	Plan													Expert	WASAC	Member of the Team are appointed in August 2017	
	Actual																
1.2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.	Plan													Expert	WASAC	in process	
	Actual																
1.3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan													Expert	WASAC	Framework of Action Plan was approved in the seminar on May 29, 2018	
	Actual																
1.4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan													Expert	WASAC	Delay	
	Actual																
1.5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.	Plan													Expert	WASAC	Not yet	
	Actual																
1.6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan													Expert	WASAC	Not yet	
	Actual																
1.7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.	Plan													Expert	WASAC	Not yet	
	Actual																
1.8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan													Expert	WASAC	Not yet	
	Actual																
1.9 The management team prepares the 5-year Strategic Acton Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan													Expert	WASAC	Not yet	
	Actual																
1.10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan													Expert	WASAC	Not yet	
	Actual																
1.11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan													Expert	WASAC	Not yet	
	Actual																
1.12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Plan													Expert	WASAC	Not yet	
	Actual																
Output 2: Basic knowledge, skills and technique on NRW control are acquired by WASAC.																	
2.1 Training materials on NRW control are prepared.	Plan													Expert	WASAC	Completed	
	Actual																
2.2 Training on NRW management is conducted for the management team and WASAC	Plan													Expert	WASAC	Completed	
	Actual																
2.3 OJT is conducted on the updating of GIS data, using available GIS data base.	Plan													Expert	WASAC	Completed	
	Actual																
2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan													Expert	WASAC	Completed	
	Actual																
2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan													Expert	WASAC	in process	
	Actual																
2.6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Plan													Expert	WASAC	in process	
	Actual																
2.7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan													Expert	WASAC	in process	
	Actual																
2.8 Training materials on NRW are reviewed and updated.	Plan													Expert	WASAC	Not yet	
	Actual																
2.9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan													Expert	WASAC	Not yet	
	Actual																

Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.						
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1.	Plan / Actual	Expert / WASAC	Member of the Team are appointed in August 2017		
3.2	The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Plan / Actual	Expert / WASAC	Completed		
3.3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1.	Plan / Actual	Expert / WASAC	Completed		
3.4	The action team hydraulically isolates Pilot Area 1, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1.	Plan / Actual (Procurement of Equipment and Construction of Chamber)	Expert / WASAC	Completed		
3.5	The action team establishes the baseline NRW rate of Pilot Area 1.	Plan / Actual	Expert / WASAC	Not yet		
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Plan / Actual	Expert / WASAC	Not yet		
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	Expert / WASAC	Not yet		
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan / Actual	Expert / WASAC	Not yet		
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual	Expert / WASAC	Not yet		
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan / Actual	Expert / WASAC	Not yet		
3.11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual	Expert / WASAC	Not yet		
3.12	The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.	Plan / Actual	Expert / WASAC	Not yet		
3.13	The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.	Plan / Actual	Expert / WASAC	Not yet		
3.14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.	Plan / Actual	Expert / WASAC	Not yet		
3.15	Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.	Plan / Actual	Expert / WASAC	Not yet		
3.16	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.	Plan / Actual	Expert / WASAC	Not yet		
Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.						
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan / Actual	Expert / WASAC			
4.2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan / Actual	Expert / WASAC			
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.	Plan / Actual (Construction of Chamber; Procurement of Equipment; Installation of Equipment)	Expert / WASAC			
4.4	System input to each of 4 branches is measured.	Plan / Actual	Expert / WASAC			
4.5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.	Plan / Actual	Expert / WASAC			
Duration / Phasing		Plan / Actual				

Monitoring Plan		1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)				Remarks	Issue	Solution
		I	II	III	IV	I	II	III	IV	I	II	III	IV			
Monitoring		8 9 10 11 12	1 2 3	4 5 6	7 8 9 10 11 12	1 2 3	4 5 6	7 8 9 10 11 12	1 2 3	4 5 6						
Steering Committee	Plan													Project Kick-off meeting was held on Aug. 18, 2016.		
	Actual															
Set-up the Detailed Plan of Operation	Plan													Work Plan was submitted to WSAC on Aug. 18, 2016.		
	Actual															
Submission of Monitoring Sheet	Plan															
	Actual															
Monitoring Mission from Japan	Plan															
	Actual															
Joint Monitoring	Plan															
	Actual															
Post Monitoring	Plan															
	Actual															
Reports/Documents																
Inception Report	Plan															
	Actual															
Progress Report	Plan															
	Actual															
Project Completion Report	Plan															
	Actual															
Public Relations																
Seminars and Workshops	Plan															
	Actual															

TO CR of JICA　RWANDA　OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet ：Ver.4（Term: July, 2017 – July, 2018: 2nd Phase）

Name: Shigeo OTANI

Title: Chief Advisor/ Non-Revenue Management

Submission Date: August 27, 2018

I. Summary

1 Progress

1-1 Progress of Inputs

1-1-1 Japan Side

(1) List and Assignment Terms of Japanese Experts

a. Working in Rwanda

Table 1.1 Assignment Term in Rwanda (Phase 2) Working in Japan

	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2017/8/5	2017/10/16	2.43
			2018/3/18	2018/5/16	2.00
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2017/8/5	2017/9/17	1.47
			2018/5/24	2018/7/12	1.27
3	NRW Reduction Plan 1（1）	Chiaki SUZUKI/ Hiroyuki YAMAGUCHI	2017/8/5	2017/9/23	1.67
			2018/1/16	2018/3/1	1.50
			2018/5/9	2018/7/7	1.77
4	NRW Reduction Plan 1（2）	Hiroyasu YODA	2017/11/8	2017/12/22	1.50
			2018/3/18	2018/5/16	2.00
5	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2017/8/5	2017/9/3	1.00
6	Leak Detection	Junichi TAKAHASHI	2017/12/3	2018/2/15	2.50
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO			
8	ICT	Marcel Brouwer			
Total MM					19.11

Note: Man Month (MM)

b. Working in Japan

Table 1.2 Assignment Term in Japan

No.	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2018/6/4	2018/6/8	0.25
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2017/8/1	2017/8/10	0.40
			2017/10/30	2017/11/9	0.40
Total M/M					1.05

Details of each expert's assignment are shown in the Plan of Operation (see Project Monitoring Sheet-II "Plan of Operation").

(2) List of Equipment Provided for the Project

Table 1.3 List of Equipment

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Output 2	Materials and equipment for training for pipe repairing and service connection	set	1	Consultant	May. 2017 Completed	not yet
Lot 2	Output 3	Customer meter DN15mm	sets	400	Consultant	Feb. 2017 Completed	not yet
Lot 3	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge,　etc.	set	1	Consultant	May. 2017 Completed	not yet
Lot 4	Output 4:　Isolation of 4 Branch	Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.	set	1	JICA office	June 2019 Scheduled	not yet
Lot 5	Vehicles for JICA use	Minibus and Pickup	Units	2	JICA office	Jan. 2017 Completed	not yet

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity		Schedule	Handover to WASAC
Lot 6	Output 2:　Leak detection equipment（for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	sets	3	JICA HQ	Jul. 2017 Completed	not yet
Lot 7	Survey Equipment for Output 2and 3	Potable GPS, Potable Test Meter, Residual Chlorine Test Meter, Potable Electric conductivity Meter	set	1	Consultant	Oct. 2016 Completed	not yet

Note:　Those items are used for the training activity during the Project period.
The above mentioned equipment except Lot 5 should be handed over to WASAC immediately after delivery and WASAC will maintain them. The equipment of Lot 5 will be managed by the JICA Expert Team during the Project period and shall be handed over to WASAC at the end of the Project period

1-1-2 Rwanda Side

(1) Counterpart

Table 1.4 List and Assignment Terms of Counterparts

No	Position	Field in Charge	Name	Duration	
				From	To
Steering Committee (SC)					
1	Chairman	CEO of WASAC	James Sano	Aug, 2016	Sept. 2017
			Aime Muzora	Sept, 2017	Present
2	Project Director	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
3	Project Manager	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug, 2016	Present
4	Management Team			Aug, 2016	Present
5	Officials from MINIFRA			Aug, 2016	Present
Project Director and Manager					
1	Project Director	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
2	Project manager	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug, 2016	Present
Management Team (9 persons)					
1	Leader	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
2	Co-leader	Director of CS	Lucien Ruterana	Aug, 2016	Sept. 2017
			Felix Gatanazi(Acting)	Sept. 2017	March, 2018
			James Mwijukye	March, 2018	Present
3	Co-leader	Director of CFO	Joseph Ruhingura	Aug. 2016	Sept. 2017
			Samson Hategekimana(Acting)	Sept. 2017	March, 2018
			Ceaser Nkusi Nkwesi	March, 2018	Present
4	Member	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
5	Member	Manager of Water Operation Services, UWSS	Innocent Gashugi	Aug. 2016	Present
6	Member	Manager of Utility Planning Services, UWSS	Dominic Murekezi	Aug. 2016	Present
7	Member	Manager of Revenue Management Services, CS	Alex KANSIIME	March, 2018	Present
8	Member	Head of billing and revenue collection, CS:	Désiré Kayiru	Aug. 2016	Present
9	Member	Manager of Customer Service Management, CS	Felix Gatanazi	Aug. 2016	Present
10	Member	Head of Marketing	Marie Therese Masimbi	Jan. 2016	Present
Action Team (31 persons)					
1	Leader	Head of leak detection and pressure management, NRW, UWSS	Désiré Ntamuturano	Aug. 2016	Present
2	Co-Leader	Kachiru Branch Manager	Musabyeyez Jeanne	Aug. 2016	Present
3	Co-Leader	Gikondo Branch Manager	Mutamba Jane	Aug. 2016	Sept. 2017
			Mr.Tuyisenge Vedaste	Sept. 2017	Present
4	Co-Leader	Nyarugenge Branch Manager	Byamugisha Bernard	Aug. 2016	Present
5	Co-Leader	Nyamirambo Branch Manager	Saranda Catherine	Aug. 2016	Present
6	Co-Leader	Kanonbe Branch Manager	Aimable Ndagijimana	Aug. 2016	Sept. 2017
			Mr.Mukiza Anaclet	Sept. 2017	Present
7	Co-Leader: Remera Branch Manager	Remera Branch Manager	Gilbert Mulindabigwi	Aug. 2016	Present
8	Member	Head of zoning and mapping services, NRW, UWSS	Jean Paul Kayitare	Aug. 2016	Present
9	Member	Head of water distribution services, WOS, UWSS	Anselme Mugabo Kimenyi	Aug. 2016	Sept. 2017
			Celestin Mwambutsa	Oct. 2017	Present
10	Member	Leak detection and pressure management Officer	Celestin Mwambutsa	Aug. 2016	Oct. 2017
11	Member	Fraud Investigation Officer	Viateur Munyanshongore	Aug. 2016	Present
12	Member	Mapping Officer	Claudien Mazimpaka	Aug. 2016	Present
13	Member	Head of meter management services	Felecien Niringiyimana	Oct. 2016	Present
14	Member	Water Distribution Officer of each Branch	Kacyiru, Ntarugenge, Nyamiranbo, Kanombe, Remera	Aug. 2016	Sept. 2017
			Kacyiru, Ntarugenge, Nyamiranbo, Kanombe, Remera (replacement)	Oct. 2017	Present
15	Member	Customer Service Officer of each Branch		Aug. 2016	Present
16	Member	Billing Officer of each Branch		Aug. 2016	Present

Table 1.5　Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Celestin MWAMBUTSA	Head of water distribution services, WOS, UWSS
Output 3	Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

(2)　Facilities

- Office space for Japanese experts at WASAC Head Office, office furniture
- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

(3) Local Cost

- Cost for administering the Project (utilities for expert offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project for 2nd Phase

Start-up Meeting of the Project was held Aug. 9, 2017 with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Submission of Progress report (Part 1), Monitoring Sheet (Ver. 3), Work Plan (Ver. 3)
- Brief explanation of Project implementation for Phase 2
- Schedule of Management Team Meeting (Joint Monitoring) and Steering Committee (SC)

(2) Management Meeting (Joint Monitoring)

In the third joint monitoring conducted at the management team meeting held on August 9, 2017, the Work Plan of Phase 2 and Monitoring Sheet (Ver.3) were submitted. The topics for discussion of the past joint monitoring are shown below.

Table 1.6　Main items checked and actions taken in the joint monitoring

No.	Implementation period	Main items checked and actions taken	Changes to R/D, PDM, PO, etc.
Version 1	September 15, 2016	None in particular	None
Version 2	March 15, 2017	・ The activities of Output 1 (Activities 1.2 to 1.10) have been extended for about 3 months → To be completed by the end of August 2017 ・ The activities of Output 4 (Activity 4.3) has been extended due to the delay in procurement of equipment → Activities to continue in Phase 2	PO Version 1 →PO Version 2
Version 3	Aug 9, 2017	・Joint Monitoring Progress of each activity (preparation of 5YSP, Technical training, Pilot project, Isolation of 4 branches, Equipment procurement, others) ・Work Plan for Phase 2 Outputs ・Contents and implementation schedule of the Pilot Project	PO Version2 →PO Version3
Version 4	Scheduled at August 2018 (before Monitoring Mission)	Progress until June 2018 of Phase2 Achievements, issues and challenges	

(3) Steering Committee (SC)

The second Steering Committee meeting was held on October 12, 2017 with the participation of members of the Management Team, Action Team and MININFRA.　In the SC meeting, the following items were approved.

1) Project monitoring

Based on Monitoring Sheet Ver.3 submitted on August 9, 2017, the progress of the Project was confirmed. The 5-year Strategic Action Plan (5YSAP) for NRW reduction which was due to be completed in August 2017 was somewhat delayed, but its completion as a draft report by the end of September was approved. After official approval by a WASAC senior management meeting and the board of directors, it was decided to carry out the individual activities with the regular budget from October 2017.

2) Phase 2 Work Plan (Ver.3)

The content of the Phase 2 Work Plan, which was submitted to the Management Team on August 9, was approved.

3) Various indexes of the project

Concrete numerical values were decided for the indicators shown in the table below.

Table 1.7　PDM of the Project

Narrative Summary	Objectively Verifiable Indicators
【Overall Goal】 WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city（year 2022: xx %）
【Project Purpose】 WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1：5-year Strategic Action Plan (5YSP) for NRW reduction is approved by the MININFRA. 2：Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3：The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan
【Outputs】 Output 1. Planning capacity of NRW reduction of WASAC is enhanced.	1：5YSP is reviewed and updated, taking into account of the results of the Pilot Project. 2：All the project achievements are shared by WASAC and other concerned parties by holding seminars.
Output 2. Basic knowledge, skills and technique on NRW control are acquired by WASAC.	1：More than XX number of trainees receive training. 2：WASAC human resource development plan includes training programs prepared by the project.
Output 3. WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	1：NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. 2：Action team members share experiences at workshops regarding implementation of the pilot projects. 3：The action team prepares a completion report of the pilot project.
Output 4. 4 branches in Kigali establish the system to measure NRW rates accurately.	1：NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.

Table 1.8　Determinations of Indicators

Output	Objectively Verifiable Indicators
【Overall Goal】	NRW rate of Kigali city（year 2022 **25 %**）(to be confirmed during the project)
【Outputs】	
Output 2.	1：More than **300** number of trainees receive training.
Output 3.	1：NRW rates are reduced at each pilot area as follows: Pilot Area 1: from **37% to 20%** and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.)

Note:・25%: Targeted value 25% (2021/22) of five years business plans revised by NRW 5YSP

・300 people: Estimate it from the training results of first Phase

・36%: Average NRW rate for June, July and August in Pilot Area 1.

This was corrected to 37% in the review of March 2018.

・20%: Targeted value that was made from targeted value 25% of business plans for five years

4) Assessment of project capability (capacity assessment: CA)

The capacity assessment on this project shall be implemented in accordance with the work items prescribed in the NRW Reduction 5-year Strategic Plan, and the targeted outputs of this project and the capabilities of

each of the relevant WASAC departments/sections indicated in the Strategic Plan shall be assessed.

The results of holding SC meetings and future plans and agenda are as shown in the table below.

Table.1.9 The held time of the SC meeting and the agenda

Time	Holding time	Theme, contents
1st	April 3, 2017	・Discussion of the work plan (WP1), approval ・Confirmation of the Rwandan side burden matter
2nd	October 12, 2017	・Progress confirmation of the project ・Common knowledge of the NRW reduction 5YSP ・Approval of the second work plan ・About the enforcement of the project evaluation
3rd	At the time of Project Monitoring in August, 2018	・Result of Joint Monitoring ・ Procurement and Installation Plan of the Equipment for Monitoring System ・Monitoring result of the JICA Monitoring Survey Mission
4th	At the time of project completion, scheduled in May 2019	・Result of Joint Monitoring ・Monitoring result of the JICA Monitoring Survey Mission

(4) Weekly Meeting

As a rule, PIM meetings are held at the end of every week and the activities for the week are reported, the activities scheduled for the following week are confirmed and pending issues, matters of concern, requests, etc., are discussed. The meetings are also utilized as a venue for training through seminars and workshops on matters proposed by the experts, etc. Meetings have been held sixty times as of the end of May 2018 (including thirty times in Phase 1).

(5) Project Progress Report (Part 1)

Project Progress Report (Part 2) was submitted to JICA and WASAC at the end of June 2018 and in August, respectively.

1-2-2: Training in Japan and in the 3rd Country

(1) Training in Japan

Table 1.10 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5	- Introduction to water service management and NRW - Outline of water facilities in Yokohama and Kobe Cities and other matters
2	August 14 to 30, 2017	Business affairs and GIS matter	5	- Introduction to water service management and NRW - Customer information management, meter management and reading, and water service management - Examples of how local governments utilize GIS, purposes of use, and other matters
3	Nov. 13 to 30, 2017	Technical matter	5	Introduction to NRW, pressure management, leak detection, distribution management, and other matters

(2)　Training in the 3rd country

Training in the 3rd country was conducted in Kenya as shown in the table below.

Table 1.11 Training in the 3rd country

No	Timing	Field of training	Trainees	Training Themes
1	May 7 to 10, 2018	Management Team	2	An introduction and discussion of activity on NRW reduction carried out in each other's countries.

1-2-3: Activities of Output

【Activities of Output 1】:

Planning capacity of NRW reduction of WASAC is enhanced.

1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.

The member of the management team and action team were appointed formally and teams were organized in August 2016 by CEO, but CEO of WASAC Mr. James Sano retired on September 1, 2017, and Mr. Aime Muzora who was a director of MININFRA took office as a successor. Following this, there were personnel changes and the resignation of the WASAC staff in September and had the effect in a management team and action team partly.

a. Management Team

The directors of commercial and financial departments resigned, and successors took office.

Table 1.12　Movement of Management Team

Section	Predecessor	Acting	New appointment
Director CS	Lucien Ruterana	Felix Gatanazi	James Mwijukye
Director　CFO	Joseph Ruhinyura	Samson　Hategekimana	Ceaser Nkusi Nkwesi

c.　Action Team

There was the transfer of two directors of Gikondo and Kanonbe, and five WDO of Kacyiru, Nyarugenge, Nyamirambo, Kanombe, Remera. But three peoples of the WDO are reliefed between the branches in the Kigali city.

Table 1.13　Movement of Action Team

Branch	Predecessor	New appointment
Branch Manager		
Gikondo	Mutamba Jane	Tuyisenge Vedaste (from Bugesera)
Kanombe	Aimable Ndagijimana	Mukiza Anaclet　(from Nyagatare)
WDO		
Kacyiru	Claudien Ruwabuneza	Alexis Dushimimana (from HQ)
x Nyarugenge	Damascene Nsengimana	Etienne Rutagengwa (from Remera)
Nyamirambo	Pierre Claver Mukimbiri	Noel Kanamugire (from HQ)
Kanombe	Antoine Muhawenimana?	Pierre Claver Mukimbiri (from Nyamirambo)
Remera	Etienne Rutagengwa	Damascene Nsengimana (from Nyarugenge)

1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

Problems and causes about NRW have been extracted in workshops which were held in succession in the first Phase.

Table 1.14　Process of Assess NRW Reduction Measures

No	Item	Implementation period	Details
1	Distribution of questionnaires to the 20 branches	Sept. 2016	Organization, outline of water supply facilities, customer information, NRW percentage, flow rate meters, water leakage investigation equipment, pipe repair equipment, water theft, water meters, etc.
2	Analysis of questionnaires	Sept.-Oct.2016	
3	Seminar	Nov. 8, 2016	on the questionnaire analysis results
4	Field surveys and reporting and issue identification at weekly meeting	Sept.2016 to March 2017	Confirmation of questionnaires, visits to facilities, interviews with branch managers, operators, etc., sharing survey results.
5	NRW strategic action plan workshop GP1	March 20-22, 2017	NRW reduction plan: Workshop on identification of issues

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

From the information obtained in Activity 1-2 and the survey of the 6 branches within Kigali City and the existing water supply facilities (field surveys, questionnaires, GIS, water consumption data), the issues were identified, and the countermeasures and orders of priority as of November 2016 were summarized.

Thereafter a series of workshops were held, based on the wishes from the WASAC side for more detailed investigation of the issues and causes. The framework of the 5YSP for NRW Reduction formulated through the workshops.

Table 1.15　Process of workshop for 5YSP for NRW reduction

No	Item	Date	Details
1	GP2	April 5-6, 2017	Workshop to analyze causes, formulate measures, and select components
2	GP3	April 21, 27-28, 2017	Workshop to compare and combine the issues identified by JICA specialists and the issues and measures identified by WASAC
3	GP4	May 5, 12, 15 and 22, 2017	Workshop regarding the selected components, formulation of order of priority of countermeasures, and establishment of framework
4	Seminar	May 29, 2017	The framework for the 5-year Action Plan for NRW Reduction was approved
5	GP5	August and September, 2017	Formulation of specific action plan for corresponding measures. Preparation of Final Draft Report of 5YSP
6	GP6	October 4, 2017	Joint workshop (management team, action team, 6 branch managers), discussion of Final Draft

In the table, the methods of dealing with issues were grouped, forming 5 main compornents and grouped in 42 countermeasures (133 specific actions), to form the main components of the 5YSP. These were classified based on the International Water Association (IWA) water balance table.　Also the year of implementation and sections responsible were formulated. The framework for the 5YSP was approved by the seminar held on May 29, 2017.

1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

The inventory survey was carried out by the GIS team of WASAC, and the preparation of the schematic layout drawing of the distribution reservoir facilities was completed in October, 2017. However, as a result of on-site verification of the results, many deficiencies were recognized and the work need to be performed a second time because the results would not withstand actual use. It is desirable that this work is performed in the 5YSP activities.

1-5　Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP.

The final draft report of 5YSP was completed in the end of September, 2017, and the report was discussed in the workshop which called a branch manager and the main staff of the Kigali city 6 Branch on October 4. With that in mind, in the second SC held on October 12, 2017, under participation of MNINFRA and the management team and the action team of WASAC, common knowledge and the agreement formation of 5YSP (Final Draft) was planned between all related sections. Afterwards, furthermore discussions were carried out mainly by NRW unit to make it practice, and a monitoring plan of implementation of 5YSP was added.

- Workshop　：October 4, 2017
- Steering Committee　：October 12, 2017

1-6　The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

WASAC management recognized the importance of the institutional reorganization and currently the structure is been revised by senior management. This new structure is also intended to enhance NRW management mainly by emphasizing on some activities such as data analysis, water leak detection, water leak repairs, etc., which is insufficient at present.

A monitoring team consisting of six senior managers has been appointed by WASAC management to carry out monitoring of the implementation of the 5YSAP.

1-7　The management team prioritizes and schedules the conducts of specific actions of 5YSP

The yearly implementation schedule of each specific action was prepared. As a future issue, it is required the detail action plan including the procurement of the logistics (survey, repairing, vehicle etc.) at each section of the head office and branch offices.

The specific action in 5YSP which is able to be performed in the annual action plan of each branch will be implemented sequentially for the time being.

Project manager and a JICA expert visited all 20 branches from early April to early July of 2018 to explain contents and the templates of monthly report of 5YSP.

1-8　WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.

The budget for the financial year (July 2018 to June 2019) was scheduled to be added and amended with the approval of the 5YSP Report by the WASAC Board. There is not influence in particular about the implementation for the time being, because most of the activity for NRW reduction was in the normal budget (Utility Budget: Flow expense and OPEX: maintenance expense)

1-9　The management team prepares the 5YSP that summarizes the achievements from Activities 1-1 to 1-7.

The management meeting collected all managers of DUWSS, all section heads was held on November 14, 2017, and the latest edition of the report was explained. It was decided to change its name from "5-year strategic action plan (5YSAP)" to "5-year strategic plan (5YSP)" in the meeting. A result was reported to CEO and each Branch Manager on the next day.

A report was submitted to the Senior Management Team by the project director Mr. Methode on December 15, and the report was approved in the Senior Management Meeting held on February 12, 2018.　5YSP was finally officially approved by the WASAC Board of Directors on April 27, 2018. After responding to the comments received, the final approval of the WASAC Board of Directors was obtained on April 27. Implementation of the plan has been delayed by 1 year relative to the schedule, and will be commenced in fiscal year 2018/2019.

1-10　The management team holds seminars and presents 5YSP (Activity 1-8) for WASAC and other concerned parties.

5YSP was shared with the relevant persons in MININFRA and WASAC at the SC meeting on October 12, 2017.

1-11 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

5YSP is updated as necessary. It is scheduled to be updated in October, 2018 and March, 2019, based on the result of the Pilot Projects for Output 3.

1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

It is scheduled for March 2019.

【Activities of Output 2】:

Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2-1 Training materials on NRW control are prepared.

The training materials (text, presentation materials, etc.) in each field were prepared at each time.

2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.

Awareness of NRW management has been deepened by implementation of training in Phase 1, and, through the series of workshops held in the process of formulating the 5YSP.

Table 1.16　Output of Training in NRW Management

Required Capacity	Training Item	Achievements and Challenges
Understanding of definition of NRW and components of NRW	General items	Sufficient understanding of the components of NRW, in accordance with the definitions of the IWA.
Preparation of NRW reduction action plan	5YSP	Understanding of the details of countermeasures and activities through the process of study of the preparation of the 5YSP.
Implementation, management and monitoring of NRW reduction action plan	5YSP	Preparation of activity monitoring report format.
Evaluation of NRW reduction activities	Pilot Project capacity (Cost-benefit analysis)	Implementation of training in accordance with the progress of the Pilot Project.
Analysis of NRW components	Pilot Project capacity (Water distribution analysis)	Implementation of training in accordance with the progress of the Pilot Project.

Preparation of NRW reduction measures manual	Pilot Project capacity (Implementation manual)	Implementation of training in accordance with the progress of the Pilot Project.

2.3　OJT is conducted on the updating of GIS data, using available GIS data base.

Training relating to updating of GIS data has already been completed (Phase 1 August to November 2016). The timing of development of WASAC GIS data (pipe network data, customer data) by ESRI and introduction of software (ArcGIS) was unclear, so it was not possible to commence specific activities using ArcGIS. In addition, the GIS Team has comparatively high individual skills in the use of the ArcGIS software, but the organization itself cannot fully utilize the software. As the results of implementing the training as indicated in the following table based on this situation, the WASAC staff involved in the work regarding GIS fully understood the processes of setting for updating the GIS data and know-how in connection with these operations.

Table 1.17　Output of Training in GIS

Required Capacity	Training Item	Achievements and Challenges
GIS data updating (customer data, pipe network data)	・ Continuous updating of GIS data (customer and pipe network data, new customers) ・ Updating data using Manuals (GIS Procedure Guide and GIS Operation Manual)	Degree of achievement: B Training was carried out into reassessment and improved efficiency of the current flow for updating in WASAC, using usable data. The staff understood the skills and techniques necessary for updating of data. In the future, it will be necessary to change the updating procedures in accordance with circumstances, such as completion of the ESRI work, etc., but the staff will be capable of dealing with these. The target of the technology transfer was only 5 members of the GIS Team, but the technologies can be spread to other members by utilizing the manuals that have been provided.
Sharing and practical use of GIS data	・ Utilization and sharing of GIS data in WASAC ・ GIS data sharing by QGIS and Google Earth ・ Use of drawings created using GIS	Degree of achievement: B Training in utilization and sharing was carried out for a total of 20 members of staff for whom there is a possibility that they will be involved with GIS in the future. The response of the staff members to the introduction of the QGIS data set was good and significant. There were major advantages in that each member of staff could immediately look up elevations, etc., on their PC, and in addition, there is the awareness effect that they will become familiar with the use of GIS.
Transfer of applied technology related to layout and data analysis by ArcGIS	・ Method of preparation of “data-driven pages” ・ Method of constructing and analyzing an [ArcGIS Geometric Network], for analyzing pipe networks using ArcGIS	Degree of achievement: B These two applied functions of ArcGIS were introduced to 2 or 3 members of the GIS team, and an extremely good response was obtained. On this occasion, it was not possible to provide instruction on these functions to the practical use level, but it can be greatly utilized in the work of the staff in the future.

Notes)　A：The training target has been sufficiently achieved, and activities can be carried out systematically without problem.
B: The training target has been virtually achieved, and if there is a wish to implement the plan at management level then there is the potential for systematic development.
C：There is a moderate level of achievement, and with the accumulation of work experience in the future, there is a prospect

of development at the individual level.
D: The degree of achievement is insufficient, and further training is necessary.
E： There is no potential for growth.

2.4　OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

The training was carried out in Phase 1 from August to November 2016. Before this, there were no personnel or departments within WASAC with experience of hydraulic analysis. Moreover, as a result of the delay in developing GIS data, software dedicated to hydraulic analysis (Mike Urban) has not been licensed and introduced. Therefore, training was carried out on the basic theory and using alternative software, for C/P personnel responsible for GIS and design having the role of constructing DMA and that are expected to utilize software in the future.

Table 1.18　Output of Training in Hydraulic Analysis

Required Capacity	Training Item	Achievements and Challenges
Understanding of purpose of use of hydraulic analysis	・ Understanding and purpose of hydraulic analysis (What to do with hydraulic analysis？)	Degree of achievement: C The vision of hydraulic analysis goes beyond each of the individual components of the technology, so it is substantially advanced and difficult. It is difficult to become proficient through lectures, and even if there has been two-way discussion, ultimately each individual must diligently gain insight.
Understanding of general basics of hydraulic analysis	・ Basic knowledge of hydraulic analysis ・ Understanding of Hazen-Williams formula	Degree of achievement: B The general basics of hydraulic analysis have been understood. However, the amount of practice is insufficient, so the ability to apply it to practical work is insufficient.
Handling of existing data (GIS, water consumption) required for hydraulic analysis	・Flow of data in WASAC and handling of data ・Quality of data and reliability of hydrological analysis results	Degree of achievement: C Repeated lectures were given on the organized flow of data in WASAC. The analysis practices were carried out using actual data in order to demonstrate to WASAC staff how difficult it is to achieve success. Degree of achievement: B The importance of the quality of data has been understood. However, this is a long-term organizational issue, and is not a problem that can be immediately solved by the GIS Team alone. Whether or not WASAC can construct an effective data collection system remains to be seen.
Understanding of ways of using hydraulic analysis software	・How to use EPANET ・How to use simple conversion application to join EPANET and WASAC GIS ・How to use Mike Urban	Degree of achievement: A Regarding the methods of use of hydraulic analysis apps with EPANET and Mike Urban, staffs have been using PCs for a long time, so they quickly became proficient in the use of analysis apps. Staffs have become proficient in the basics and manuals have been provided, so in the future they will be able to proceed with practical examples while investigating on their own.

2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

Water volume control and water pressure control are important items for water leak control. In the case of water volume control, the amount of water leakage in the water supply pipes and main

distribution pipes can be generally determined by measuring the flow rates in pipeline segments using exposed pipes such as raised aqueduct or pipes attached along a bridge. It is also possible to determine the amount of water leakage by measuring the Quantity Minimum Night Flow (Qmnf) of a distribution pipe network at each DMA (District Metered Area), and to narrow down the location of the water leak by carrying out a step test or direct measurement on the pipeline (modified step test).

Table 1.19　Output of Training in Leak Detection

Required Capacity	Training Item	Achievements and Challenges
Leakage point detection work	・ Capable to understand water leak surveys/functions of leak detector, and to operate the equipment. ・ Capable to understand the general basics of the method of detection of sound source for water leak detection. ・ Capable to understand purposes of water leak surveys, purposes of use of detector, as well as to choose suitable equipment in accordance with the circumstances on site. ・ Capable to choose the equipment suitable for sound source detection on metal pipes, non-metal pipes, small-diameter pipes, large diameter pipes, distribution pipes, and water supply pipes.	Degree of achievement: B There are no problems regarding the use of water leak detector, but further proficiency can be expected by further efforts through practical work. The trained staff can provide training to other members of staff. There are no vehicles only used for surveys, and the survey system has to be put together ad hoc. This technology is still new and requires time for the team to get more experience. The number of staff in WASAC dedicated to leak detection is low. The complexity of the site (not always paved road and not well known network). Some equipment (correlators) are not fitting with the majority of WASAC existing network condition.
Water volume control	・ Capable to carry out continuous measurement (monitoring) over a long period using a data logger. Capable to understand the basic of signal measurement. ・ Capable to collect and visualize flow rate data before analysis. ・ Capable to conduct surveys of water leak amount by the nighttime minimum flow rate method. ・ Capable to determine important zones for water leak detection by sub-zone step tests and direct measurement. ・ Capable to estimate water leak quantities between two locations by measuring the flow rates at some different points.	Degree of achievement: B The theory of measurement and methods of use of ultrasonic flow rate meters have been understood. The trainees identified the water leak quantities by measuring the nighttime minimum flow rate and carrying out a step test on the WASAC pipeline and confirmed the effectiveness of the method of tracking the area where the water leak exists, as well as understood how to carry out these operations. They are now capable of using these methods in practice on their own judgment.
Water pressure control	・ Capable to carry out continuous measurement (monitoring) over a long period using a data logger. Capable to understand the basic of signal measurement. ・ Capable to collect and visualize water pressure data before analysis. ・ Capable to understand the basics of water pressure data signal measurement. ・ Capable to understand the relationship between high water pressure and NRW.	Degree of achievement: C The general basics of measurement and the method of use of water pressure gauges were understood. Monitoring can be carried out using a data logger. In undulating topography, there are many areas with excess pressure, but dynamism and motivation of trainees are insufficient for active risk management.
Formulation of plans for water leak detection operations	・ Capable to understand water leak surveys and detection methods and choose effective methods in accordance with the circumstances of the water distribution pipe network. ・ Capable to understand the relationship between water pressure and flow rate. ・ Capable to evaluate the distribution pipe network,	Degree of achievement: D The ability to formulate water leak survey plans for water distribution networks has not been achieved. In order to carry out an effective water leak survey, it is necessary to form DMAs in the distribution network, and as such, a more detailed study should be carried out for appropriate layout of reservoirs, etc., and

	make judgments of what part is functionally impaired, and formulate improvement measures. ・ Capable to elaborate plans of water leak surveys with awareness of the 5YSP.	development of distribution network. It is necessary to select areas available for water leak surveys, and it is needed to carry out work to hydraulically isolate the area.
Maintenance of water leak detector	・ Capable to decide on the storage location of the equipment, and to store the equipment in an orderly manner. ・ Capable to appoint a person responsible for the storage, in order to prevent loss of equipment, and to maintain records of issuing the equipment. Capable to carry out minor maintenance such as replacement for poor connection of dry or other batteries.	Degree of achievement: D One room in WASAC Headquarters is used for storage of the equipment, but the space is narrow, and the arrangement is not tidy. A control record register has been prepared for issuing equipment, but it is not being properly used. A person responsible for maintenance has not been appointed. The point of contact for repairs whenever there is a breakdown of equipment has not been determined.

WASAC did not possess the practical techniques for systematic measures against losses, but as a result of this training, members of staff of the NRW Section have learned the methods of using water leak survey and detection equipment, and the methods of carrying out surveys and detection using this equipment. In particular, through the activities of the Pilot Project, WASAC has acquired the techniques of detecting visible water leaks, which it could not achieve previously, and this is a major breakthrough. The invisible water leakage as a percentage of the NRW in the WASAC water distribution network is extremely high, and it is expected that these techniques will contribute greatly to the NRW reduction activities of WASAC.

The training enabled WASAC to have the minimum necessary equipment for water leaks survey and detection, and to foster technicians capable to carry out water leak survey and detection, although the number of them is small, so in the future it will be necessary to extend this practically to specific activities in the WASAC branches.

The NRW Section does not systematically plan leak detection work. It is desirable that an overall plan be formulated in accordance with the 5YSP for the activities of WASAC as a whole, while utilizing the experience accumulated in the Pilot Project of this Technical Cooperation Project. To this end, it is necessary to create an implementation mechanism by carrying out reorganization at Headquarters or at branch level, for carrying out survey and detection.

2.6　In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

The training in this field was mainly carried out for members of staff in the branches, so the six branches in Kigali were visited sequentially, the status of work was closely examined, and OJT was carried out on methods of constructing water supply pipes.

The majority of locations where water leaks occur are on water supply pipes. Therefore, the emphasis in training was put on the following points in construction, and training was provided in thermal welding of HDPE pipe, proper hole drilling using drills (non-water supply suspension cutting method), proper cutting of screw treads using dies, methods of wrapping Teflon tape, measurement of water pressure and

measurement of residual chlorine after drilling, backfilling of pipes, etc.

- When a branch is formed from a water distribution pipe using a saddle, a hole is formed in the water distribution pipe using a heated steel rod. High pressure occurs, if the hole is too small, which causes damage to the saddle packing and cracking on the pipe wall.
- PVC pipe or HDPE coils are joined by forming screw threads. Therefore, the pipe wall pressure is reduced.
- When cutting screw treads (with a die), water is used and not oil.
- Sealing tape (Teflon) is wound too much. The screw threads do not come into close contact because of this excess of winding, which causes division at the screws. Moreover, workers do not peel old sealing tape, but wind over it.
- The chippings of pipe material that occur after pipe repair are not removed, mud that falls into the pipe during operations is not removed, and connections are made while this remains. Pipe cleaning is not carried out. This causes blockage of meters.
- The pressure resistance of pipe material is not uniform when a mixture of PN16 and PN10 is used.
- The quality of the pipe material is poor, so longitudinal splitting of PVC and HDPE pipes occurs due to high water pressure.
- After carrying out a repair, water is not applied in order to check whether there is a water leak.
- Vehicles are driven even on small, unpaved roads, which can cause damage to pipes due to insufficient depth or inappropriate backfill. The excavated soil such as clay in which consolidation settlement can easily occur or gravel is used as backfill, and this can cause new pipe cracking and water leakage. Sufficient compaction of the pipe foundation is not carried out, and this causes water leaks.
- Procurement of pipe materials and excavation of the pipe route for laying these pipes are carried out by consumers, and quality is not ensured.
- When carrying out water leak repairs or connections of a new water supply pipe, there are no valves nearby so it is not possible to shut off the water, and this causes lost water.

2.7　In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

In the Pilot Project, emphasis was placed on the accuracy of the customer meters used as the main cause of the apparent loss of NRW, and in-situ calibration of the meters and replacement of the meters in accordance with the result is proceeding. At WASAC previously meters were only replaced in the event of a breakdown, and assessment of accuracy on the WASAC test bench was only carried out when the meter had been procured and when there was a complaint from a customer.

As a result of the activities of the Pilot Project, the following issues became apparent, and training in methods to deal with these is scheduled to be continued by OJT.

1) Appropriate processing of data on water consumption amount (occurrence of NRW in the process of water metering and consumption)

- When a meter was replaced, the amount of water used between when the meter was read and when it was replaced or the estimated amount of water was lost in terms of accounting. Correction of the programming of the CMS system for customer data management is required.
- The criteria of the method of estimating the volume of water consumption when it was not possible to read the meter are unclear.

2) Establishment of methods of analyzing customer data

- The purpose of monitoring and analyzing the quantity of water consumption for each customer is not recognized (detection of abnormal data, water consumption volume processing errors, meter faults, detection of suspected theft of water, etc.)
- A database for analysis of customer data has not been prepared. Even though there is GIS customer data and Commercial Services Department customer data, they have not been linked, so their uses are limited. Therefore, it is an urgent task to prepare a unified database for all branches.
- There is no manual for the methods of analysis of customer data. Almost all of those responsible in each of the branches are beginners in the use of Excel and Access software, and at present are occupied with basic operations such as data input, calculation, etc. In addition to improvement in basic capabilities, it is necessary to provide training to improve the capabilities of the members of staff to deal with data modification, cross tabulation, methods of detecting abnormal data, preparation of graphs, determining customer properties, and other simple analysis methods.
- The operability for processing a large amount of data with the Excel software is limited, and the potential for making a mistake is large, so it is desirable that this is dealt with by programming such as a Customer Management System (CMS), etc., as the method for processing and analyzing complex customer data.

3) Meter calibration method, and establishing criteria for replacement of meters

- Customer meters with problems in measurement accuracy (about 20% of all customer meters) are used over the long term, and are left as they are.
- From the lessons learned in Pilot Project 1, the criteria for the calibration operations on site using a simple test meter were reviewed, and it was planned to implement them in Project 2. At the same time, the criteria for meter replacement were justified based on the calibration results.

4) Allocating POC numbers to customer addresses

- A POC label (seal/metal plate) is applied to the customer residence.
- Preparation of POC map (plotting on GPS map, conversion to GIS data).
- In order to automatically add the POC of the new customers that are increasing every month to the pilot area (DMA) customer list, a DMA code for the pilot area is allocated to the POC data of the CMS.
- In order to link to the GIS customer data, it is necessary to collect the required customer data at the same time as the new customer contract. It is necessary to create a system to be implemented responsibly by a branch WDO or a technician.

5) Dealing with disconnection, and abandoned public water taps

- In the case of customers for whom measures have been taken to stop their water supply, the risk of illegal use of the water supply increases, so it is necessary to carry out tracking surveys after taking measures to stop their water supply. As the survey method, interview surveys for each household are proposed in order to confirm the local situation and the items required for each customer, etc.
- Since water supply to a public water tap is suddenly interrupted because of non-payment of charges (2 weeks or more), many customers act repulsively, and there is a strong possibility that it can cause illegal use and illegal connections, etc. Even if there is a need to stop the water supply, sufficient care should be taken with respect to the users.

2-8 Training materials on NRW are reviewed and updated.

Updating will be carried out through implementation of the pilot project of Output 3, after March, 2019.

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

Updating will be carried out through implementation of the pilot project of Output 3, after March, 2019.

【Activities of Output 3】

: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

A. Project Preparation

3-1 The action teams are organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.

The counterparts were formally appointed by the CEO, and formation of the Action Team was completed in August 2016. However, as stated previously, there was relocation of personnel in September 2017, and this had some effect.

3-2 The action team grasps the current situations of Pilot Area 1 and Pilot Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.

Selection of two pilot areas (Area 1: Kadobogo of Kacyiru Branch, Area 2: Ruyenzi of Nyarugenge Branch) from the proposed candidate sites in September 2016. Information data of two pilot areas were collected in September 2016. Afterward, information data of pilot areas such as POC list and boundary

were updated.

Customer list (POC: Point of Connection) and the POC location map of the pilot area (Kadobogo) were provided from the Kacyiru Branch and GIS section respectively. However, in local findings through the site work such as onsite meter test and leakage inspection, it became clear that some POCs which did not match with the local situation were included in POC list and/or the POC location map, and adversely, the POCs which should be existed in the area were not included. This correction took long time because of the difficulty to confirm POC number onsite.

It was decided that the NRW rate which has been calculated so far at each sub-zone are reviewed again after a list of POC were revised. As a lesson, preparation of a list of POC and the POC location map are basics of the project work. These are extremely important information to conduct the routine onsite work of WASAC such as meter reading, meter test, meter investigation and leakage survey. It was proposed to stick the seal which displayed a POC number on the gate of each house

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Pilot Area 2.

A work plan of pilot project for area1 and Area 2 was prepared.

3-4　The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1and 2.

Construction of chamber and installation of the measuring equipment in the chamber has completed in May, 2017.

B.　Activity of the Pilot Area 1

3-5　The action team establishes the baseline NRW rate of Pilot Area 1

The boundary reconfirmation and correction by the hydraulic isolation work was made in December, 2017. The measurement of the inflow of pilot area 1 and 2 was started in June, 2017 and NRW rate of each month have been calculated. However, about baseline of NRW, it was reviewed after the correction of the POC list.　As the baseline the mean of 2 months June and July, 2017 was adopted.

Table 1.20　Base line of Pilot Project 1

Items	Unit	June, 2018	July, 2018	Average
Connection	Number			
Input Discharge	m3	19,054	20,389	19,722

Billed water	m3	11,345	13,412	12,379
NRW	m3	7,709	6,977	7,343
NRW Rate	%	40.5%	34.2%	37.2%

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.

The onsite meter test was carried out from August 27, 2017 through December 29, 2017. The meter with value of the error more than ±5% and defaulted were replaced with new meter during the period from September 8, 2017 to May, 2018.

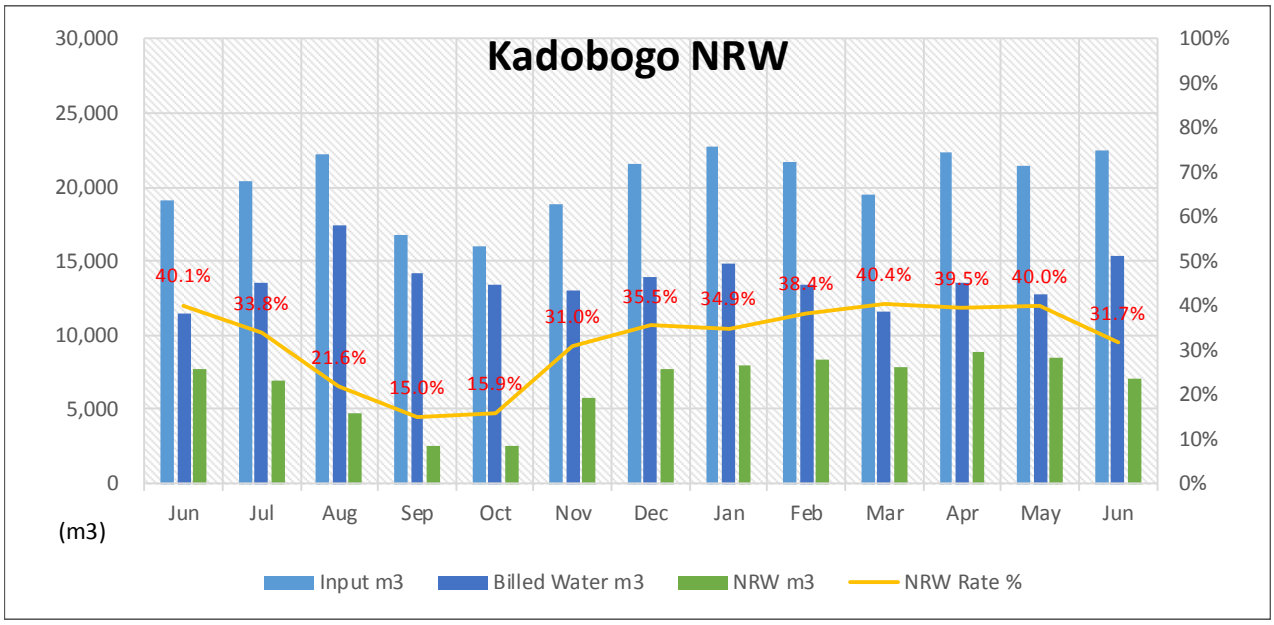
Table 1.21 Onsite meter test results

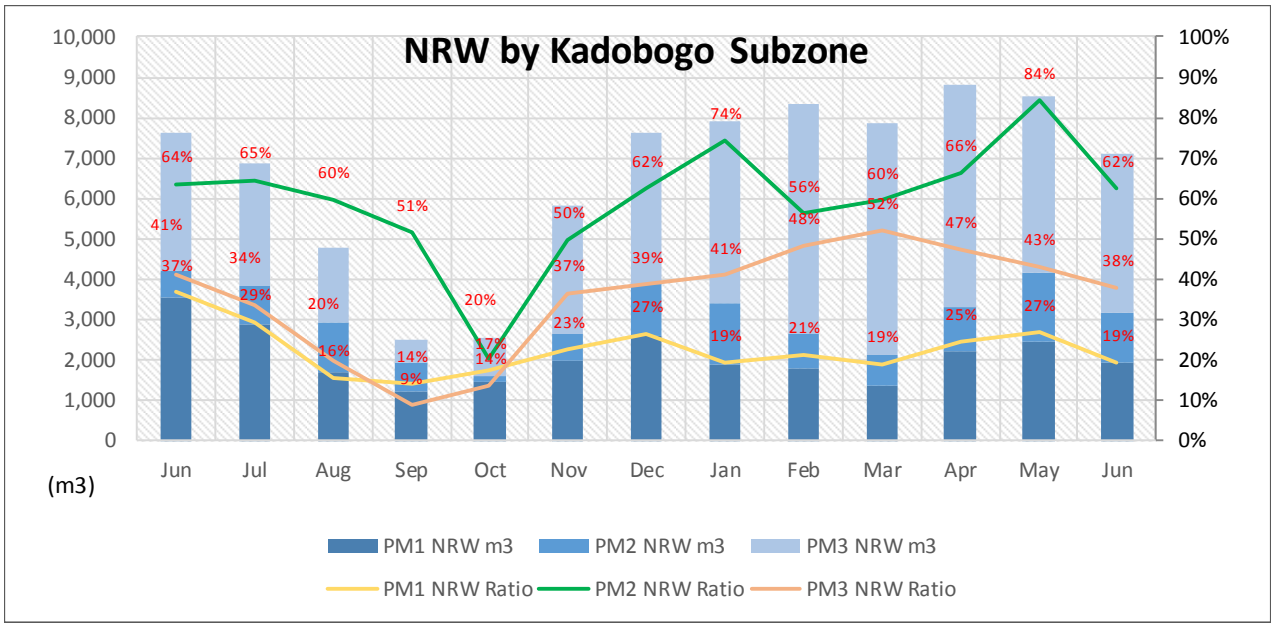
Sub-Zone	Normal	Error> ±5%	Meter Blocked	Faulty Meter	Illegals	No Meter	Leaks	Stop Valve Blocked	Disconnected
PM1	428	117	9	40	3	2	2	13	1
PM2	34	9	0	0	0	0	0	0	0
PM3	319	80	3	35	2	0	1	10	6
Total	781	206	12	75	5	2	3	23	7

3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness

NRW rate is calculated every month from June 2017.

NRW Rate in Kadobogo





PM Number	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Billed water	11,404	13,500	17,374	14,246	13,397	12,959	13,908	14,765	13,351	11,579	13,499	12,822	15,340
PM1	6,088	6,947	9,089	7,286	6,882	6,766	7,122	7,710	6,602	5,808	6,790	6,684	8,182
PM2	381	506	839	666	668	692	768	531	664	503	557	322	742
PM3	4,935	6,047	7,446	6,294	5,847	5,501	6,018	6,524	6,085	5,268	6,152	5,816	6,416
Input Volume	19,054	20,389	22,169	16,762	15,936	18,793	21,555	22,694	21,677	19,439	22,328	21,373	22,445
PM1	9,634	9,847	10,771	8,491	8,332	8,741	9,706	9,577	8,391	7,179	8,995	9,134	10,134
PM2	1,049	1,429	2,087	1,373	837	1,378	2,044	2,061	1,519	1,243	1,659	2,030	1,978
PM3	8,371	9,113	9,311	6,898	6,767	8,674	9,805	11,056	11,767	11,017	11,674	10,209	10,333
NRW	7,650	6,889	4,795	2,516	2,539	5,834	7,647	7,929	8,326	7,860	8,829	8,551	7,105
PM1	3,546	2,900	1,682	1,205	1,450	1,975	2,584	1,867	1,789	1,371	2,205	2,450	1,952
PM2	668	923	1,248	707	169	686	1,276	1,530	855	740	1,102	1,708	1,236
PM3	3,436	3,066	1,865	604	920	3,173	3,787	4,532	5,682	5,749	5,522	4,393	3,917
NRW ratio	40.1%	33.8%	21.6%	15.0%	15.9%	31.0%	35.5%	34.9%	38.4%	40.4%	39.5%	40.0%	31.7%
PM1	36.8%	29.5%	15.6%	14.2%	17.4%	22.6%	26.6%	19.5%	21.3%	19.1%	24.5%	26.8%	19.3%
PM2	63.7%	64.6%	59.8%	51.5%	20.2%	49.8%	62.4%	74.2%	56.3%	59.5%	66.4%	84.1%	62.5%
PM3	41.0%	33.6%	20.0%	8.8%	13.6%	36.6%	38.6%	41.0%	48.3%	52.2%	47.3%	43.0%	37.9%

The NRW rate that decreased once tends to increase after November, 2017. As this reason, the following possibility was assumed.

① Consumption of water was not billed by the omission of list of the new customer of the pilot area.

② Because of the defect of calculation method with the replacement of the meter, consumption of water that was measured by the previous meter was not considered.

③ Actual progress of the replacement work of the defective meter is late than a branch report, and effect expression by the meter replacement is late.

④ Many leaks of water occur frequently routinely without the basic countermeasure to high water pressure and to use of poor quality pipe. Leaks left as it is for a long term especially in the case of invisible leakage without being repaired.

⑤ Correspondence of the Kacyiru branch to the leak of water discovered and illegal use is late.

⑥ Increase of illegal use of water by the increased disconnected customer.

3-8　The action team conducts measures for reducing surface leakage (visible leakage).

It was carrying out from December, 2017. The visible leakage was found routinely. Because it is necessary to repair it immediately when a leak of water is found, its repair work has taken simultaneously with apparent loss measures.

3-9　The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

NRW rate is calculated every month from June 2017.

3-10　The action team conducts measures for reducing underground leakage (invisible leakage).

The measurement work of leakage abundance started by NRW team in January, 2018 and the team chose an area with much quantity of leakage. Then, “the modified step test” was conducted on March 22, and the identification of the leakage spot was succeeded in that day. The NRW team succeeded in discovery of big leakage points continuously afterward.

3-11　The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

NRW rate is calculated every month from June 2017.

3-*　The action team conduct measures for reducing high pressure.

Some high pressure zones have been identified within the pilot area, the procurement of PRV and the construction of manhole is under preparation.

3-*　The action team measures NRW after conduction Activity 3-12 and examines their effectiveness.

Not yet

3-12　The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.

The implementation in September 2018 or later is planned based on the work plan.

3-13　The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.

The implementation in November 2018 or later is planned based on the work plan.

3-14　The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.

The implementation in December 2018 or later is planned based on the work plan.

C. Activity of the Pilot Area 2

3-15　Action team conducts activities at Pilot Area 2.

1) Preparation Works

The customer POC number survey was carried out on site in March and April 2018 collecting positional coordinate data using mobile GPS. Based on the results, the POC positions were input onto GIS distribution pipe maps that were prepared superimposed on Google Maps, to produce the POC position maps. Based on these maps, the operation of confirming the hydraulic isolation in areas and zones within the areas was carried out, to determine the boundaries. In the course of this work, the POC list and the POC position maps were readjusted.

Based on the lessons learned from Pilot Area 1, in Pilot Areas 2 it was decided to apply the POC seals prepared in the Project to the customer residences. It was also decided to investigate methods of taking high-pressure reduction measures prior to carrying out the measures against actual water leaks. The implementation policy was as follows.

- Calculate the baseline NRW rate value based on the POC list completed at the end of April 2018.
- Carry out continuous calculation of the NRW rate every month.
- Install PRV after studying measures against high pressure and verifying the positions to install PRV. Carry out water pressure measurement for this purpose.
- Set tertiary pipe areas in three locations for analysis of water distribution rate, and measure the nighttime flow rate.
- Conduct a meter survey at all customer locations, and implement meter calibration in selected locations.
- Replace defective meters with new ones.
- Conduct a minimum nighttime flow rate survey and step tests in each zone.
- Detect water leak locations and carry out repair work.
- Complete the work by December 2018, and carry out evaluation in January 2019.

2) Measurement of the baseline NRW rate

From the below table, it can be seen that the NRW rate in April 2018 was extremely high at 72.3%. The baseline NRW rate prior to the NRW reduction activities was taken to be the average value of the NRW rate in the recent two months 64.4% and 72.4% (March, April), which is 68.4%.

Table1.22　Ruyenzi NRW rate

Table-Ruyenzi NRW Analysis

DMA Number		Jan*	Feb*	Mar	Apr
Billed water		21,574	17,441	19,486	17,540
	RY1	14,084	11,762	12,849	11,845
	RY2	2,900	2,097	2,666	2,543
	RY3	4,590	3,582	3,971	3,152
Input Volume		55,992	53,704	54,812	63,327
	RY1	34,610	33,840	38,085	45,469
	RY2	12,580	11,560	7,480	8,790
	RY3	8,802	8,304	9,247	9,068
NRW		34,418	36,263	35,326	45,787
	RY1	20,526	22,078	25,236	33,624
	RY2	9,680	9,463	4,814	6,247
	RY3	4,212	4,722	5,276	5,916
NRW ratio		61.5%	67.5%	64.4%	72.3%
	RY1	59.3%	65.2%	66.3%	73.9%
	RY2	76.9%	81.9%	64.4%	71.1%
	RY3	47.9%	56.9%	57.1%	65.2%

Water Transmitted		Jan*	Feb*	Mar	Apr
Gihara Res.	Total	15,218	15,766	18,003	14,472
	Area	6,416	7,462	8,756	5,404
Bisheny		NA	NA	1,265	631

Note: Water transmitted to Bisheny area in January and February from RY1are not considered in the values of input volume and NRW of the same months.

D.　Manual and Seminar

3-16　Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

The implementation in November 2018 or later is planned based on the work plan.

【Activities of Output 4】:

4 branches in Kigali establish the system to measure NRW rates accurately.

4-1　Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

Four branch separation boundary lines were established by the end of September, 2016. The review of the hydraulic isolation plan is completed in the 1st Phase. About the decision of the boundary of 4 branches (Nyarugenge, Gikondo, Kacyiru, Nyamirambo), a close inspection was made by the collaboration with a WASAC GIS team, WDO of the branches and the JICA expert team.

The result of the close inspection was discussed in a project management meeting of October 7,

2016, and the position of the boundary line was settled.

As a result, there is the boundary position correction between existing branches to some extent, and the adjustment between branches of the customer registration with it is required.

The number of the movement of the customer between the branches is almost just what to show it in table below. The adjustment work on the customer registration list will be performed together in the process of equipment procurement schedule for the construction of hydraulic isolation systems.

Table 1.23 The number of the movement of the customer

Before movement	After movement	Customers
Kacyiru	Gikondo	4
Kacyru	Remera	15
New Nayrugenge	Kacyiru	11
New Nayrugenge	Namirambo	435
Gikondo	Remera	1314
TOTAL		1779

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

The flow rate monitoring system for measuring the amount of water distributed to each branch in order to calculate the NRW consists of devices for measuring data (flow rate, pressure) installed on site, and data collection equipment installed at WASAC Headquarters. The data measured on-site is transmitted to the data collection equipment via a mobile telephone transmission network (GPRS). The data collection equipment is a server that carries out data collection, accumulation, and display. However, its scale is the minimum necessary, and it does not include software for analysis and statistical processing of the collected data, or preparation of graphics. The data information is in text format, so WASAC process it in an Excel table, and calculate the NRW rate for each branch.

In addition, the system of the SUSWAS project (27 places of electromagnetic flowmeters) is to be compiled into the system of this project.

The review of the hydraulic isolation plan has completed and the locations to install an electromagnetic flowmeter and pressure gauge were determined in the joint meeting held between NRW, GIS and O&M team on October 31, 2016.

4-3 Electromagnetic flowmeters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.

- Among 23 places of concrete chambers to install procurement equipment in it, the chambers of 22 places are completed at a stage in the end of April, 2018. The remaining one chamber is under construction.

Table 1.24　Status of construction of the Chamber（As of the end of July 2018）

No. of Chamber	Status	Note
M1、M2、M4、M5、M6、M12、M13、M15、M17、M19、M23	Completed on May 25, 2017	1st Phase
M7、M8、M9、M10、M11、M14、M16、M18、M20、M21	Completed on August 3, 2017	2nd Phase
M22	Completed on October 13, 2017	2nd Phase
M3	Under the construction	Expected to complete in September 2018

- The tender for procurement of the monitoring system equipment being implemented by JICA was officially announced on May 26, 2017, but the business conditions of the tenderers were not good enough and the technical specification of the equipment did not satisfy the requirements, so in October 2017 it was terminated unsuccessfully. Thereafter, JICA Headquarters decided to carry out a re-tender, and at present, tender preparations are being made in Japan. It was decided to implement a lump-sum contract that includes the installation work.
- The overall procurement schedule is delayed by more than one year from the Plan of Operation (PO) decided in RD, and the reasons for this delay and the future schedule was explained to the head of the DUWSS by JICA Headquarters on April 17, 2018. WASAC expressed regret regarding this delay.
- Regarding the details of the equipment, time has passed since the local tender was carried out in May 2017, so a survey was carried out again regarding the local situation.
- The monitoring system is expected to complete by the end of June, 2019.

4-4　System input to each of 4 branches is measured.

The measurement of distribution volume in each branch will be started after construction of monitoring system.　It is expected that the measurement of the quantity of water distribution in each branch in the Kigali city with the system will be conducted after July 2019. The NRW rate is calculate based on measured distribution quantity.

4-5　Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.

The calculation of NRW rate in each branch will be started after construction of the monitoring system.

1-3 Achievement of Output

Achievement status of the Project outputs is observed according to the PDM indicators.　Refer to

Project Monitoring Sheet I (PM Form 3-2).

1-4 Achievement of the Project Purpose

Project Purpose

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.

Objectively Verifiable Indicators

1. 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.
2. Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC.
3. The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction

Means of Verification

1. 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure
2. Annual action plan of WASAC
3. Budget of WASAC

5YSP for NRW reduction was approved by the Board of Directors of WASAC on April 27, 2018. Afterward, the Action Plan should be approved by the Minister of Infrastructure. Action Plan of 6 branches in Kigali City should be reflected in annual action plan of WASAC. The budget for implementing Action Plan of 6 branches in Kigali City should be approved.

1-5 Changes of Risks and Actions for Mitigation

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

(1) Pre-Conditions

Table 1.25 Actions for Mitigation on Pre-Condition

PDM Pre-Conditions	Current Situation	Action for Mitigation
1 GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.	1-1 By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017. Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule. In the beginning of September 2017, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikUrban was made by Esri in the end of October 2017.	

(2) Important Assumption on Proceeding Assumptions (from Outputs to Project Purpose)

Table 1.25 Action for Mitigation on Important Assumption (from Outputs to Project Purpose)

Table 1.26 Actions for Mitigation on Important Assumption

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The non-revenue water section at WASAC is not subject to large scale reorganization.	1-1 Structure of WASAC was devised on March 2, 2017, but does not lead to the enforcement as of June 2017. On the project, it is thought that there is not the substantial influence. Movement of the GIS section to under the WOS unit.	
2 WASAC staff dose not resign after training by the Project.	1-2 Not applicable	
3 Large scale natural disaster does not occur.	1-3 Not applicable	

(3) Important Assumption on Proceeding Assumptions to Overall Goal

Table1.26 Action for Mitigation on Importance Assumptions (from Project Purpose to Overall Goal)

Table 1.27Actions for Mitigation on Important Assumption

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The Government policy on NRW remains as highly prioritized.	1-1 NRW still high priority	

1-6 Progress of Actions undertaken by JICA

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment was procured in July 2017.
- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is behind the schedule.

1-7 Progress of Actions undertaken by Rwanda side

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Preparation of 5-year Strategic Action Plan for NRW reduction.
- Joint visit JICA-WASAC of WASAC's upcountry branches.
- Training in Japan
- Training in the third Country

1-8 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

None

2 Project challenges

2-1 Detail

The issues regarding project implementation and operation and the findings of technical matter are as follows.

1. The preparation of the 5YSP took long than expected, almost additional one-year compared to the initial plan. The 5YSP was approved by WASAC Board of Directors on April 27, 2018, and it was decided that its implementation will start from fiscal year 2018/2019. Meanwhile, dissemination to 20 branches staff has been completed, and it has been recommended to branches its consideration in the preparation and implementation of the annual plan and budget.

The implementation of some activities planned in the 5YSP is already started and will require close monitoring and updating the contents in order to reflect lessons learned from the activities performed in the Pilot areas and NRW monitoring system, etc.. However, remaining time of the present project period is not enough to consider its result for the update of the 5YSP. In addition, the successful implementation of the 5YSP will requires some institutional reorganization and more support (logistic means,equipements etc…)

2. About a construction of the Monitoring System, we observed some delays caused by unsuccessful tender in Rwanda, insufficient JICA budget. However, the completion of the installation of the monitoring system is estimated in June 2019, there will not be time for practicing measurements and reflection time of the lessons learned from result of measuring water balance to 5YSP.

3. It is important that awareness of the NRW activities should be recognized throughout the whole WASAC organization. Depending on the department, there is a tendency towards low awareness and participation in the Project due to being busy with day-to-day work. WASAC top management need to emphasis on the importance of involvement of each WASAC staff in NRW reduction activities.

4. One of the lessons learned from Pilot Project 1 was that although not initially envisaged as being a major factor, invisible water leakage was a major source of loss. The importance of measurement of flow rate in DMAs was recognized. Because of this, identifying the areas with large water leakage by means of the step test was necessary, but it was sometimes affected by the not accurate service pipe distribution drawings, and the absence of valves on branch distribution pipelines point.

5. Leak detection still challenging mainly because of ground (not always paved road) and network condition (sometimes no valve for a long distance). In addition the number of staff trained for leak detection still low and sometimes difficulties from Japanese expert to transfer knowledge about detection

6. A feature of the topography of Kigali is its severely undulating topography. Residences have been formed on the slopes and bottoms of hills, so the water supply and distribution facilities are extremely complex. The facilities have been developed only for the purpose of transmission and distribution of water, and countermeasures against water pressure have not been taken into consideration. Therefore, there are high water pressures in the distribution pipes, and as a result, water leakages can easily occur. Even when the leak location is repaired, new leaks frequently occur because of this reason, sometimes together with the sub-standard of pipe, so it is recognized that countermeasures against high water pressure are indispensable. Control of pressure reduction is extremely important as a preventative measure.

7. In almost all cases, leakages are reported on service pipe. From the installation location conditions, pipes that are easy to lay such as polyethylene are widely used. However, procurement of the pipe that is used is done by the customer, the material quality is frequently poor (from various aspects such as price, and local availability), and material is not selected by taking into account pressure resistance.

Quality of the installation works such as pipe connection and backfill of the pipe are also frequently not well done. Therefore, in many cases, the pipe cannot resist high-pressure and consequently causing water leaks. The importance of preventative measures such as compliance with standardized equipment, uniform materials, appropriate construction, etc.. should be recognized. Therefore, as the permanent solution it is necessary to consider pipe procurement and installation methods under WASAC responsibility, while prohibiting the procurement of the materials by customers. (Radical Treatment/Preventive measure)

The issues regarding project implementation and operation are as summarized in the table below.

Table 2.1 Issues regarding project implementation and operation

Item	Subject	Issue	Countermeasure
1. Activity on each Output			
Output 1 1-4	Inventory survey of facilities condition	Facility schematic drawing of reservoirs were prepared by GIS Team in October 2017. However, the results were not sufficient.	Inventory of the facility and equipment will be summarized in the 5YSP.
1-6	Organizational change	Some activities for NRW reduction such as customer data analysis, management of data collected by monitoring system, meter management, leak survey and high pressure control, examination of WASAC policy on service pipe management etc.are not yet sufficiently performed under the current organizational structure. There is need to review the organizational structure to ensure successful implementation of the 5YSP.	The change of organizational structure is under review by senior management. WASAC top management need to emphasis on the importance of involvement of each WASAC staff in NRW reduction activities.
1-7	Specific action plan and budget	The dissemination of the 5YSP to 20 branches has been completed, but it is necessary that each branch customize its implementation, and establish a budget plan. Remaining time in the present project period is not enough.	The 5YSP should be reflected in the Branch annual action plan and budget.
1-8	Budget	Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX) However, the allocated budget still not sufficient	Look for other financing mechanism/partners
1-11	Implementation schedule	Commencement of 5YSAP is delayed by one year relative to the original schedule of PO. Updating the contents is now required in order to reflect the lessons learned from the activities of the Pilot Project and monitoring of water balance in Branch areas in the project period. However, the remaining time in present project period is not enough.	Extension of project period is required.

1-11	Monitoring on the implementation of 5YSP	The time is not enough in the remaining project period.	Extension of project period is required.
Output 2 2-2 to 2-7	Trainings (from 2.2 to 2.7)	Capacity Assessment of the new knowledge acquired through training has not yet been conducted	This should be conducted soon by the project.
Output 3 3.6	Improvement of CMS system	Billing quantity of the replaced mater and DMA code giving are not reflected.	ICT team should modify programming of CMS immediately.
3-10	Leakage survey and repair	Invisible water leakages were succeeded in the detection from the latter half of March 2018. A leakage occurs in sequence even if leakages were repaired, because of high pressure and poor quality of pipe material.	Pressure reduction measures should be taken immediately. Leakage survey will be continued after taking pressure reduction measures.
3-11	NRW ratio of Pilot Area 1	The NRW ratio as of June 2018 is 31.7%. It decreased from 40.3% of May by 8.6%, because of the invisible and visible leakages repair. However, there is still difference from the targeted value.	The achievement of 20% of targeted value is expected by the pressure reduction measures and continuous leakage repairs.
3.5	NRW rate baseline of Pilot Area 2	In Area 2, baseline of NRW rate 68.4% was decided as mean value of March 2018 and April 2018. The rate is too high. Many visible leaks are observed. The poor quality of pipes and high pressure is probably the main cause of this high rate.	The way of pressure control should be considered for Pilot Area 2 also. Procurement of the PRV equipment and construction of the chambers should be speed up.
*****	Proof of effect of the activities	The effect of the activities, pressure reduction and replacement of poor quality service pipe, have not been yet demonstrated.	In Pilot Area 2, these should be proved.
*****	High pressure control of Pilot Area	High water pressure is probably the main cause of leakage. High water pressure has not been managed in the network.	The PRVs should be installed at each sub-zone in Kadobogo for pressure control. Procurement of the PRV equipment and construction of the chambers should be speed up.
*****	Quality of the service pipe	Sub-standard on the quality and installation of service pipe is main cause of leakage.	WASAC should change the present policy and develop the new standard. Set up the study team or committee.
3-11	Calculation of Amount of NRW and NRW rate	Calculation of NRW amount and NRW rate is not yet performed by the Action Team	WASAC side should managed after completion of the installation of monitoring system
3-16	Dissemination of the effect of pilot project result	The remaining time of the present project period is not enough to share and disseminate its results.	Extension of project period is required.

Output4 4-3	Construction of the Monitoring System	We observed some delays caused by unsuccessful tender in Rwanda, insufficient JICA budget, However, the completion of the installation of the monitoring system is estimated in June 2019, there will not be time for practicing measurements and reflection time of the lessons learned from result of measuring water balance to 5YSP.	The procurement and installation work by JICA should speed up. This issue will be discussed in the Monitoring Mission of JICA HQ which is scheduled in August 2018.
4-2	Re-registration of the customer transferred due to the change of new proposed branches boundaries	Movement by the change of boundary line made by the hydraulic isolation.	Commercial department and GIS team will conduct before completion of the monitoring system.
4-4 and 4-5	Training of data management after construction of the monitoring system	However, project completion will be expected in June 2019, so there will not be time for practicing measurements after construction of the system in the project period.	JICA is considering the extension of the project period for one year.
4-4 and 4-5	Clarification of the Unit in charge of monitoring system operation and data management	Unit in charge of the monitoring system management (hard & soft) is not yet clarified.	Responsible unit should be clarified.
2.　General			
	Awareness of the NRW activities	It is important that awareness of the NRW activities be shared throughout the whole organization of WASAC. Depending on the department, there is a tendency towards low awareness of participation in the Project due to being busy with day-to-day work.	The actions of the management team and the project monitoring need to be more active. Joint Monitoring should be conducted at least every three months by the management team.
	Equipment handover	Handover procedure is delaying. Lot 1: Equipment for training on pipe repair and service pipe connection Lot 2: Pilot Projects (Customer Meter) Lot 3: Pilot Projects (Gate valve, flow meter, and customer meter) Lot 4: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve) Lot 5: Vehicles for Japanese experts Lot 6: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.) Lot 7: Mobile GPS, Potable Test meter etc.	Acceleration of the handover procedure in WASAC

3 Modification of the Project Implementation Plan

3-1 Project Design Matrix (PDM)

1)　Objectively Verifiable Indicators

The undetermined numbers xx were decided or amended in the steering committee (SC) as showing table below.

Table 3.1 Objectively Verifiable Indicators

Item	Version 1 (2nd SC: October 12, 2017)	Version 2 (3rd SC: August 28, 2018)
Overall Goal	NRW rate of Kigali city (Year 2022 25%)	Year 2022/23　25%
Outputs 2-1	More than 300 number of trainees receive training	same as it is
Outputs 3-1	Pilot Area1: from 36% to 20% Pilot Area2: from xx% to xx%	from 37% to 20% from 68% to 25%

Note:　Baseline of NRW rate of Pilot Area 1 was amended from 36% to 37%, because of correction on customer list in March 2018.

2) Modification of PDM

As a major issue, the timeline of Activity of 4.3, procurement and installation of the equipment of monitoring system, is extremely delaying for about 1.5 years. Therefore, activities 4.5 and 4.6 are not able to start in the present project period. It is expected that these activities are started from July 2019.

Table 3.2 Modification of PDM

Item	Issue	Solution
Title of the project	None	-
Duration of the Project	・(1-11)The period for update 5YSP by the knowledge and lesson getting through monitoring of water balance is not able to conduct in the present project period, because of the delay of the activity Output 4. ・(3-16)The period for disseminate the manual and use of survey equipment to the activity of other branches is not enough. ・(4-4, 5)The activities of 4-4, 4-5 are not able to conduct in the present project period.	Project period should be extended for one year.
Project site(s)	None	No change
Target group(s)	None	No change
Implementation structure	None	No change
Overall goal,	None	No change
Project purpose	None	No change
Outputs	None	No change
Activities	Items shown in the table below are proposed.	See Table 3.3 below
Input	None	No change

Table 3.3 Postscript and Correction on the Activities in PDM

Item	Original	Modification
Word change	5-year Strategic Action Plan	5-year Strategic Plan (5YSP)
Description change of Activity 1-5	Based on the results of Activity 1-4, the management team prepares on the necessary facilities improvement.	Activity 1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP.
Description change of Activity 1-7	The management team prioritizes and schedules the conducts of facilities improvement and organizational and identified by Activities 1-4 and 1-5.	Activity 1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.
Insertion of the sentence as Activity 1-11	-	Activity 1-11 The management team facilitate implementation and the monitoring of the 5YSP
Simultaneous work of Area 1 and Area 2 (from Activity 3-1 to 3-4)	Area1	Area 1 and Area 2
Insertion of the sentence as Activity 3-12 on a activity for high water pressure management	-	Activity 3-12 The action team conducts measures for reducing high water pressure.
Insertion of the sentence as Activity 3-13 on high water pressure management	-	Activity 3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.
Insertion of the sentence as Activity 3-19	-	Activity 3-19 Action team disseminate the manual and use of survey equipment to the activity of other branches.
Separation of the activities described in Activity 4-3 to “Procurement and installation of the equipment”	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches and chambers are constructed as appropriate	Activity 4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.
Separation of the activities described in Activity 4-3 to “Construction of the chambers”		Activity 4-4 Chambers are constructed as appropriate.

3-2 Plan of Operation (PO)

1) Indicators

Table 3.4 Indicators

Item	Version 1 (2nd SC: October 12, 2017)	Version 2 (3rd SC: August 28, 2018)
Training in Japan	xx persons will be trained in Japan	15 persons were trained in Japan
Training in the Third Country	xx persons will be trained in xx	2 persons went to an exposure visit in Kenya

2) Modification of PO

PO is modified based on the modification of PDM described above.

Table 3.5 Modification of PO

Item	Original	Modification
Correction of the Term	Joint Coordination Committee	Steering Committee
Project Period	Year 1, 2 and 3	Postscript of the column Year 4
Activities 1-11 and 1-12	None	Implementation in Year 4
Activity 3-19	None	Implementation in Year 4
Activities 4-5, 4-6	Implementation in Year 2 and 3	Implementation in Year 4

II. Project Monitoring Sheet I & II

As attached.

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 4

Implementing Agency: WASAC

Dated Augst 27, 2018

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2019/6/30

Project Site: 6 Branches in Kigali city(Kacyiru, Nyamirambo, Gikondo, Nyar **Model Site:**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city（year 2022/23 : 25 %)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25% in the second SC of October 12, 2017 (36% as of the end of June, 2018)	
Project Purpose					
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure	The non-revenue water section at WASAC is not subject to large scale reorganization.	5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.	
	2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC	2 Annual action plan of WASAC	WASAC staff do not resign after training by the Project.	The workshop at every branch to explain the contents of 5YSP and how to implement was carried out by Project Manager from April to July 2018. But, 5YSP is not yet totally reflected in annual action plan of each branch.	
	3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	3 Budget of WASAC	Large scale natural disaster dose not occur.	The management of WASAC has not yet see the impact of NRW reduction by the result of the pilot project. However, the management has already recognized the effect of the 5YSP, and the budget still not yet enougth .	
Outputs					
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project.	1-1 Records of the project		Pilot project 1 (Area 1: Kadobogo, Kacyiru Branch) has not yet completed.	
	1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-2 Records of the project		Seminar will be planned to take place after completion of the Pilot Project 1.	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training.	2-1 Records of the project		About482cumulative number of trainees (55Times) were received training as of the end of May, 2018.	
	2-2 WASAC human resource development plan includes training programs prepared by the project.	2-2 Records of the project		Training programs will prepared after the completion of the pilot project	
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.	3-1 Records of the project		・Two pilot areas (Area 1: Kadobogo, Kacyiru Branch, Area 2: Ruyenzi, New Nyarugenge Branch) were selected. [Area1] ・The baseline of the NRW rate 36% of Area 1 was decided in the SC of October 12, 2017, but it was revised to 37% because of mistake on the POC list. ・Implementation of the OJT for Area 1 has been started from June, 2017, and is still carrying out. ・Pressure reduction measure was added as the measure other than "Apparent Loss" and "Leakage detection and repair". Setting of PRVs are in process. ・NRW rate of June, 2018 is 32%. [Area2] ・Preparation work for Area2, POC list and Hydraulic isolation, was completed. ・The baseline of the NRW rate 68% of Area 1 was decided as the average of March and April. ・NRW rate of June, 2018 is 59%.Poor quality of pipes and high presure must be the main cause of this high NRW rate concequently the necessity of pipe	
	3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.	3-2 Records of the project		Workshop will be planned after evaluation of the Pilot Project 1. (scheduled in January, 2019)	
	3-3 The action team prepares a completion report of the pilot project.	3-3 Survey plans for locations outside the pilot project		Completion report will be prepared after evaluation of the Pilot Project 1. (scheduled in January, 2019)	
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		・Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided. ・Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey. ・The 22 chambers has been constructed as of October, 2017 and remaining one is under construction. ・The tender procedure on procurement of the equipment of monitoring system is delaying.	

Activities	Inputs		Pre-Conditions
1-1 A management team is organized to prepare 5-year Strategic Action Plan (5YSP) for NRW reduction.	**The Japanese Side**	**The Rwanda Side**	
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser／Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP ~~on the necessary facilities improvement~~	GIS	Management team members	
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	・GIS data should continue to be updated
1-7 The management team prioritizes and schedules the conducts of ~~facilities improvement and organizational and institutional changes~~ specific actions of 5YSP. ~~identified by Activities 1-4 and 1-5~~.	Leak detection	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	
1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-1 Training materials on NRW control are prepared.	Training in the 3rd country	Training room with the capacity of about 20 persons	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.		Space for training on pipe repair and service pipe connection(40㎡)	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Leak detection equipment		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Ultrasonic flow meter with data logger	3 Local cost	
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Gate valve, flow meter, and customer meter for Pilot Project	Cost for administering the Project (utilities for experts offices, internet services)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8 Training materials on NRW are reviewed and updated.	Equipment for training on pipe repair and service pipe connection	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Mobile GPS	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Vehicles for Japanese experts		
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.			
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.			
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.			
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.			
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8 The action team conducts measures for reducing surface leakage (visible leakage).			
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-** The action team conducts measures for reducing high water pressure.			
3-** The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			
3-12 The action team reviews the results from Activities 3-5 to 3-1**, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-1**.			
3-13 The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.			
3-15 Action team conducts activities from Activities 3-5 to 3-14 at Pilot Area 2.			
3-16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches~~, and chambers are constructed as appropriate.~~			
4-3 ~~Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and~~Chambers are constructed as appropriate.			
4-4 System input to each of 4 branches is measured.			
4-5 Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.			

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 4
Dated Augst 27, 2018

Project Title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs		Plan / Actual	1st Year (16/17) I–IV	2nd Year (17/18) I–IV	3rd Year (18/19) I–IV	Remarks	Monitoring	Solution
Expert								
Chief Adviser/Non-Revenue Water Management	Ootani	Plan						
		Actual						
Adviser/Non-Revenue Water Management	Higuchi	Plan						
		Actual						
NRW Reduction Plan 1 (1)	Suzuki / Yamaguchi	Plan					Mr. Suzuki retired at the end of March, 2018.	Mr. Yamaguch was assigned as the successor.
		Actual						
NRW Reduction Plan 1 (2)	Yoda	Plan						
		Actual						
NRW Reduction Plan 2 (1)	Toyoda	Plan						
		Actual						
NRW Reduction Plan 2 (2)	Tsutsui	Plan						
		Actual						
Geographic Information System: GIS	Horishita	Plan						
		Actual						
Hydraulic Analysis	Ooe	Plan						
		Actual						
Leak Detection	Takahashi	Plan						
		Actual						
Pipe Repairing and Service Connection (1)	Momozono	Plan						
		Actual						
Pipe Repairing and Service Connection (2)	Takashima	Plan						
		Actual						
Information and Communication Technology: ICT	Brouwer	Plan					Because effective time of 4.3 is undetermined, dispatch time is undecided	Schedule will be fixed at the SC which will be held in August 2018.
		Actual						
Long Term Expert	Mayusumi	Plan						
		Actual						
Equipment								
Lot 1: Equipment for training on pipe repair and service pipe connection		Plan				delivered in May 2017, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC
		Actual						
Lot 2: Pilot Projects (Customer Meter)		Plan				delivered in March 2017,in use ir the Project	not yet handed over	Acceleration of the handover procedure in WASAC
		Actual						
Lot 3: Pilot Projects (Gate valve, flow meter, and customer meter)		Plan				delivered in May 2017, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC
		Actual						
Lot 4: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)		Plan				pending	not yet procured	Re-bidding procedure by JICA is in process
		Actual						
Lot 5: Vehicles for Japanese experts		Plan				delivered in January 2017, in use ir the Project	not yet handed over	Acceleration of the handover procedure in WASAC
		Actual						
Lot 6: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.)		Plan				delivered in July 2017, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC
		Actual						
Lot 7: Mobile GPS, Potable Test meter etc.		Plan				delivered in October 2016, in use ir the Project	not yet handed over	Acceleration of the handover procedure in WASAC
		Actual						
Training in Japan								
15 persons will be trained in Japan (5, 5, 5)		Plan				Completed on schedule	None	-
		Actual						
In-country/Third country Training								
2 persons will be trained in Kenya		Plan				Completed in May 2018	None	-
		Actual						

Activities / Sub-Activities		Plan / Actual	1st Year (16/17) I–IV	2nd Year (17/18) I–IV	3rd Year (18/19) I–IV	Responsible Organization: Japan	Responsible Organization: RWANDA	Achievements	Issue & Countermeasures
Output 1: Planning capacity of NRW reduction of WASAC is enhanced.									
1.1	A management team is organized to prepare 5-year Strategic Action Plan (5YSP) for NRW reduction.	Plan				Expert	WASAC	Members of the Team were appointed in August 2016. Some change in September 2017.	None
		Actual							
1.2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigli city), and identifies problems.	Plan				Expert	WASAC	Questionnaire survey, Site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems.	None
		Actual							
1.3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan				Expert	WASAC	Discussion in a series of Workshops. Framework of Action Plan was approved in the seminar on May 29, 2017	None
		Actual							
1.4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan				Expert	WASAC	Facility schematic drawing of reservoirs were prepared by GIS Team in October 2017.	The results were not sufficient Inventory of the facility and equipment will be summarized in the 5YSP or Master Plan.
		Actual							
1.5	Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP	Plan				Expert	WASAC	Draft Final report of 5YSP was approved at the second SC on Oct. 12, 2017	None
		Actual							
1.6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan				Expert	WASAC	The organisation recoganised the importance of the organisational change and the structure is under review by senior management	The budget may be the constraint for the implementation of the new proposed structure
		Actual							
1.7	The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Plan				Expert	WASAC	A yearly implementation schedule for each specific actions and its priority were prepared.	None
		Actual							
1.8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan				Expert	WASAC	Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX)	The budget has been secured trough AfDB loan, the implementation may
		Actual							
1.9	The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan				Expert	WASAC	5YSP was officially approved by the Board of Directors on April 27, 2018.	None
		Actual							
1.10	The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan				Expert	WASAC	5YSP was shared at the SC on October 12, 2017. Approved 5YSP by both management and BoD explained at each Branch from April to July 2018.	None
		Actual							
1.11	The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan				Expert	WASAC	Not yet	None
		Actual							
1.12	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Plan				Expert	WASAC	Not yet	None
		Actual							
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.									
2.1	Training materials on NRW control are prepared.	Plan				Expert	WASAC	Completed	None
		Actual							
2.2	Training on NRW management is conducted for the management team and WASAC management as necessary.	Plan				Expert	WASAC	Completed	Capacity assement not yet completed
		Actual							
2.3	OJT is conducted on the updating of GIS data, using available GIS data base.	Plan				Expert	WASAC	Completed	Capacity assement not yet completed
		Actual							
2.4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan				Expert	WASAC	Completed	Capacity assement not yet completed
		Actual							

2.5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan / Actual	Expert	WASAC	Completed	Capacity assement not yet completed
2.6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Plan / Actual	Expert	WASAC	Completed	Capacity assement not yet completed
2.7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan / Actual	Expert	WASAC	in process	None
2.8	Training materials on NRW are reviewed and updated.	Plan / Actual	Expert	WASAC	Not yet	None
2.9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan / Actual	Expert	WASAC	Not yet	None
Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.						
A. Preparation						
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Plan / Actual	Expert	WASAC	Member of the Team were appointed in August 2017	Some of the members resigned or transferred in September 1907.
3.2	The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Plan / Actual	Expert	WASAC	Completed	None
3.3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	Plan / Actual	Expert	WASAC	Completed	None
3.4	The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Plan / Actual	Expert	WASAC	Flow meters and pressure gauges were installed in the meter chambers by May 2017.	None
B. Activity of Pilot Area 1 Kadobogo						
3.5	The action team establishes the baseline NRW rate of Pilot Area 1.	Plan / Actual	Expert	WASAC	Baseline: Mean value of June, July 2017 Original: 36.0% Revised: 37.3%	Calculation data of NRW rate had a problem, because of the inappropriate POC list. Baseline NRW rate was revised after revision of POC list.
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Plan / Actual	Expert	WASAC	The meters which should be changed were 351 as a result of on-site meter test (total connection 1,240). In this, 301 were replaced.	It took 4 months for on-site calibrations test. The improvement of the work standard was demanded for shortening at work period.
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	Expert	WASAC	in process, effect will be evaluated about the replaced meters	There is some difficulty to measure the effects separately in time as in 3.7, 3.9 and 3.11.
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan / Actual	Expert	WASAC	in process	When water leaks are discovered it is necessary to carry out repairs immediately, so meter replacement and repair of leaks were carried out in parallel.
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual	Expert	WASAC	in process	Same as Item 3.7
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan / Actual	Expert	WASAC	Invisible water leakages detections were successfully implemented in march 2018 in pilot area 1	It is still challenging for leak detection due to the ground condition ,number of equipment and few number of people trained.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual	Expert	WASAC	The NRW ratio as of June 2018 is 31.7% in pilot 1 . It decreased from 40.3% of May by 8.6%, because of the invisible and visible leakages repair .	None
3.**	The action team conducts activities for reducing high water pressure.	Plan / Actual	Expert	WASAC	Pressure Reduction Valve (PRV) in PM2 was adjusted. PRV in PM3 is in preparation for installation.	The construction of mahnhole for the protection of PRVs to be installed is delaying
3.**	The action team measures NRW after conducting Activity 3-** and examines their effectiveness.				Not yet	None
3.12	The action team reviews the results from Activities 3-5 to 3-**, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-**.	Plan / Actual	Expert	WASAC	Not yet	The works conducted in the pilot project and expended cost for that works will be summarized for cost-benefit analysis.
3.13	The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Aria 1, and submits it to the management team.	Plan / Actual	Expert	WASAC	Not yet	None
3.14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-14 to WASAC and other concerned parties.	Plan / Actual	Expert	WASAC	Not yet	None
C. Activity of Pilot Area 2 Ruyenzi						
3.2	Preparation Work (POC data compilation) (Review)	Plan / Actual	Expert	WASAC	Completed	POC number seal has been put on customers entrace gates
3.4	Preparation Work (Hydraulic Isolation of Pilot Area) (Review)	Plan / Actual	Expert	WASAC	Completed	None
3.5	The action team establishes the baseline NRW rate of Pilot Area 2.	Plan / Actual	Expert	WASAC	Baseline: Mean value of March, April 2018 Original: 68.4%	None
3**	The action team conducts measures for reducing high water pressure	Plan / Actual	Expert	WASAC	The six locations for PRV installation were decided.	Procurement of the equipment and construction of the chambers should be speed up.
3.**	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan / Actual	Expert	WASAC	Not yet	Delay of procurement of PRVs and construction of Manhole
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 2.	Plan / Actual	Expert	WASAC	General meter physical ispenction for all customers 1,623 is in progress, on site meter test and replacement not yet started.	Delay
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	Expert	WASAC	Not yet	Delay

3.8	The action team conducts activities for reducing surface leakage (visible leakage).	Plan / Actual	Expert	WASAC	In process	Delay
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual	Expert	WASAC	Not yet	Delay
3.10	The action team conducts activity for reducing underground leakage (invisible leakage).	Plan / Actual	Expert	WASAC	Not yet	Delay
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual	Expert	WASAC	Not yet	Delay
3.12	The team reviews the results of Activities, and undertakes cost-benefit analysis of NRW for each Activity.	Plan / Actual	Expert	WASAC	Not yet	Delay
3.13	The team summaries activities and results from Activities, prepares the completion report on the pilot project, and submits it to the management team.	Plan / Actual	Expert	WASAC	Not yet	Delay
3.14	The team holds a workshop and presents the completion report of the pilot project prepared by Activities to WASAC and other concerned parties.	Plan / Actual	Expert	WASAC	Not yet	Delay
D. Manual and Seminar		Plan				
3.16	Action team prepares manuals on methods and use of survey equipment learned from the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.	Plan / Actual	Expert	WASAC	Not yet	Delay
Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.						
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan / Actual	Expert	WASAC	Completed	None
4.2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan / Actual	Expert	WASAC	Completed	None
4.2	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.	Plan / Actual (Procurement of / Installation of)	Expert	WASAC	JICA HQ decided to carry out a re-tender after the pocess failed in JICA-Rwanda . JICA HQ is now in process of bid preparation. The real progress has delayed compared to the initial plan.	The wayforward will be discussed in the upcoming JICA-HQ mission planned on 28th August 2018
4.3	Chambers are constructed as appropriate.		Expert	WASAC	22 meter chambers have been constructed out of 23 planed.	the remaining one is under construction
4.4	System input to each of 4 branches is measured.	Plan / Actual	Expert	WASAC	Schedule is delay.	JICA is considering the extension of the project period for one year.
4.5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.	Plan / Actual	Expert	WASAC	Schedule is delay.	JICA is considering the extension of the project period for one year.

Duration / Phasing				
	Plan / Actual			

Monitoring Plan		1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)				Remarks	Issue	Solution
		I	II	III	IV	I	II	III	IV	I	II	III	IV			
Monitoring		8 9 # # #		1 2 3	4 5 6	7 8 9	# # #	1 2 3	4 5 6	7 8 9	# # #	1 2 3	4 5 6			
Steering Committee	Plan / Actual (Apr. 4; Oct. 12)													SC in August 2018 will be scheduled for Project Monitoring Mission		
Set-up the Detailed Plan of Operation	Plan / Actual															
Submission of Monitoring Sheet	Plan / Actual													Monitoring Sheet shall be submitted before Monitoring Mission		
Monitoring Mission from Japan	Plan / Actual													In August 2018 by JICA HQ		
Joint Monitoring	Plan / Actual															
Post Monitoring	Plan / Actual															
Reports/Documents																
Inception Report	Plan / Actual															
Progress Report	Plan / Actual															
Project Completion Report	Plan / Actual															
Public Relations																
Seminars and Workshops	Plan / Actual															

TO CR of JICA　RWANDA　OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet ：Ver.5（Term: July, 2017 – July, 2018: 2nd Phase）

Name: Shigeo OTANI
Title: Chief Advisor/ Non-Revenue Management

Submission Date: February 28, 2019

I. Summary

1 Progress

1-1 Progress of Inputs

1-1-1 Japan Side

(1) List and Assignment Terms of Japanese Experts

a. Working in Rwanda

Table 1.1 Assignment Term in Rwanda (Phase 2) Working in Japan

	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2017/8/5	2017/10/16	2.43
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/9/18	1.50
			2018/10/20	2018/11/29	1.37
			2019/1/15	2019/3/9	1.80
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2017/8/5	2017/9/17	1.47
			2018/5/24	2018/7/12	1.27
3	NRW Reduction Plan 1（1）	Chiaki SUZUKI/ Hiroyuki YAMAGUCHI Toru TOYODA	2017/8/5	2017/9/23	1.67
			2018/1/16	2018/3/1	1.50
			2018/5/9	2018/7/7	1.77
			2018/10/12	2018/12/27	2.57
4	NRW Reduction Plan 1（2）	Hiroyasu YODA	2017/11/8	2017/12/22	1.50
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/10/3	2.00
			2019/2/18	2018/4/6	1.60
5	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2017/8/5	2017/9/3	1.00
6	Leak Detection	Junichi TAKAHASHI	2017/12/3	2018/2/15	2.50
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2018/2/5	2018/4/5	2.00
8	ICT	Marcel Brouwer			
Total MM					31.95

Note: Man Month (MM)

b. Working in Japan

Table 1.2 Assignment Term in Japan

No.	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2018/6/4	2018/6/8	0.25
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2017/8/1	2017/8/10	0.40
			2017/10/30	2017/11/9	0.40
Total M/M					1.05

Details of each expert's assignment are shown in the Plan of Operation (see Project Monitoring Sheet-II "Plan of Operation").

(2) List of Equipment Provided for the Project

Table 1.3 (1) List of Equipment

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Output 2	Materials and equipment for training for pipe repairing and service connection	set	1	Consultant	May. 2017 Completed	in process
Lot 2	Output 3	Customer meter DN15mm	sets	400	Consultant	Feb. 2017 Completed	in process
Lot 3	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Consultant	May. 2017 Completed	in process
Lot 6	Output 3:	Pipes and rerated fittings for service pipe replacement in Kadobogo	set	1	Consultant	December. 2018 Completed	in process
Lot 7	Output 3:	PRV fittings in pilot area	set	1	Consultant	December. 2017 Completed	in process
Lot 4	**Output 4: Isolation of 4 Branch**	**Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.**	**set**	**1**	**JICA office**	**June 2019 Scheduled**	**not yet**
Lot 5	**Vehicles for JICA use**	**Minibus May 31, 2019 Pickup June 30, 2020**	**Units**	**2**	**JICA office**	**Jan. 2017 Completed**	**not yet**
Lot5	**Photocopy Machine**	**June 30, 2020**	**Unit**	**1**	**JICA Office**	**August 2016**	**Not yet**

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity		Schedule	Handover to WASAC
Lot 8	Output 2: Leak detection equipment（for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	sets	3	JICA HQ	Jul. 2017 Completed	not yet
Lot 9	Survey Equipment for Output 2and 3	Potable GPS, Potable Test Meter, Residual Chlorine Test Meter, Potable Electric conductivity Meter	set	1	Consultant	Oct. 2016 Completed	not yet

Note: Those items are used for the training activity during the Project period.
The above mentioned equipment except Lot 5 should be handed over to WASAC immediately after delivery and WASAC will maintain them. The equipment of Lot 5 will be managed by the JICA Expert Team during the Project period and shall be handed over to WASAC at the end of the Project period

(3) List of Facilities Provided for the Project

Table 1.3 (2) List of Equipment

Facilities to be Provided

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Chambers for Pilot Areas	2 chambers for Pilot Area1 1 chamber for Pilot Area 2	set	1	Consultant	May. 2017 Completed	Completed
Lot 2	Chambers for Monitoring System	Customer meter DN15mm	set	1	Consultant	Sept. 2018 Completed	Completed

1-1-2 Rwanda Side

(1) Counterpart

Table 1.4 List and Assignment Terms of Counterparts

No	Position	Field in Charge	Name	Duration	
				From	To
Steering Committee (SC)					
1	Chairman	CEO of WASAC	James Sano	Aug, 2016	Sept. 2017
			Aime Muzora	Sept, 2017	Present
2	Project Director	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
3	Project Manager	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug, 2016	Present
4	Management Team			Aug, 2016	Present
5	Officials from MINIFRA			Aug, 2016	Present
Project Director and Manager					
1	Project Director	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
2	Project manager	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug, 2016	Present
Management Team (9 persons)					
1	Leader	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
2	Co-leader	Director of CS	Lucien Ruterana	Aug, 2016	Sept. 2017
			Felix Gatanazi(Acting)	Sept. 2017	March, 2018
			James Mwijukye	March, 2018	Present
3	Co-leader	Director of CFO	Joseph Ruhingura	Aug. 2016	Sept. 2017
			Samson Hategekimana(Acting)	Sept. 2017	March, 2018
			Ceaser Nkusi Nkwesi	March, 2018	Present
4	Member	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
5	Member	Manager of Water Operation Services, UWSS	Innocent Gashugi	Aug. 2016	Present
6	Member	Manager of Utility Planning Services, UWSS	Dominic Murekezi	Aug. 2016	Present
7	Member	Manager of Revenue Management Services, CS	Alex KANSIIME	March, 2018	Present
8	Member	Head of billing and revenue collection, CS:	Désiré Kayiru	Aug. 2016	Present
9	Member	Manager of Customer Service Management, CS	Felix Gatanazi	Aug. 2016	Present
10	Member	Head of Marketing	Marie Therese Masimbi	Jan. 2016	Present
Action Team (31 persons)					
1	Leader	Head of leak detection and pressure management, NRW, UWSS	Désiré Ntamuturano	Aug. 2016	Present
2	Co-Leader	Kachiru Branch Manager	Musabyeyez Jeanne	Aug. 2016	Present
3	Co-Leader	Gikondo Branch Manager	Mutamba Jane	Aug. 2016	Sept. 2017
			Mr.Tuyisenge Vedaste	Sept. 2017	Present
4	Co-Leader	Nyarugenge Branch Manager	Byamugisha Bernard	Aug. 2016	Present
5	Co-Leader	Nyamirambo Branch Manager	Saranda Catherine	Aug. 2016	Present
6	Co-Leader	Kanonbe Branch Manager	Aimable Ndagijimana	Aug. 2016	Sept. 2017
			Mr.Mukiza Anaclet	Sept. 2017	Present
7	Co-Leader: Remera Branch Manager	Remera Branch Manager	Gilbert Mulindabigwi	Aug. 2016	Present
8	Member	Head of zoning and mapping services, NRW, UWSS	Jean Paul Kayitare	Aug. 2016	Present
9	Member	Head of water distribution services, WOS, UWSS	Anselme Mugabo Kimenyi	Aug. 2016	Sept. 2017
			Celestin Mwambutsa	Oct. 2017	Present
10	Member	Leak detection and pressure management Officer	Celestin Mwambutsa	Aug. 2016	Oct. 2017
11	Member	Fraud Investigation Officer	Viateur Munyanshongore	Aug. 2016	Present
12	Member	Mapping Officer	Claudien Mazimpaka	Aug. 2016	Present
13	Member	Head of meter management services	Felecien Niringiyimana	Oct. 2016	Present
14	Member	Water Distribution Officer of each Branch	Kacyiru, Ntarugenge, Nyamiranbo, Kanombe, Remera	Aug. 2016	Sept. 2017
			Kacyiru, Ntarugenge, Nyamiranbo, Kanombe, Remera (replacement)	Oct. 2017	Present
15	Member	Customer Service Officer of each Branch		Aug. 2016	Present
16	Member	Billing Officer of each Branch		Aug. 2016	Present

Table 1.5　Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Celestin MWAMBUTSA	Head of water distribution services, WOS, UWSS
Output 3	Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

(2)　Facilities

- Office space for Japanese experts at WASAC Head Office, office furniture
- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

(3) Local Cost

- Cost for administering the Project (utilities for expert offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project for 2nd Phase

Start-up Meeting of the Project was held Aug. 9, 2017 with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Submission of Progress report (Part 1), Monitoring Sheet (Ver. 3), Work Plan (Ver. 3)
- Brief explanation of Project implementation for Phase 2
- Schedule of Management Team Meeting (Joint Monitoring) and Steering Committee (SC)

(2) Management Meeting (Joint Monitoring)

In the third joint monitoring conducted at the management team meeting held on August 9, 2017, the Work Plan of Phase 2 and Monitoring Sheet (Ver.3) were submitted. The topics for discussion of the past joint monitoring are shown below.

Table 1.6　Main items checked and actions taken in the joint monitoring

No.	Implementation period	Main items checked and actions taken	Changes to R/D, PDM, PO, etc.
Version 1	September 15, 2016	None in particular	None
Version 2	March 15, 2017	・ The activities of Output 1 (Activities 1.2 to 1.10) have been extended for about 3 months → To be completed by the end of August 2017 ・ The activities of Output 4 (Activity 4.3) has been extended due to the delay in procurement of equipment → Activities to continue in Phase 2	PO Version 1 →PO Version 2
Version 3	Aug 9, 2017	・Joint Monitoring Progress of each activity (preparation of 5YSP, Technical training, Pilot project, Isolation of 4 branches, Equipment procurement, others) ・Work Plan for Phase 2 Outputs ・Contents and implementation schedule of the Pilot Project	PO Version2 →PO Version3
Version 4	August 20, 2018 (before Monitoring Mission)	Progress until August 2018 of Phase2 Achievements, issues and challenges Proposal of amendment of PO	Revision of RD, PDM, PO
Version 5	Scheduled at May 2019 (before Monitoring Mission)	Progress until May 2019 of Phase2 Achievements, issues and challenges Proposal for 4th year of the Project	

(3) Steering Committee (SC)

The results of holding SC meetings and future plans and agenda are as shown in the table below.

Table.1.9 The held time of the SC meeting and the agenda

Time	Holding time	Theme, contents
1st	April 3, 2017	・Discussion of the work plan (WP1), approval ・Confirmation of the Rwandan side burden matter
2nd	October 12, 2017	・Progress confirmation of the project ・Common knowledge of the NRW reduction 5YSP ・Approval of the second work plan ・About the enforcement of the project evaluation
3rd	August 28, 2018August 28, 2018 At the time of Project Monitoring by JICA	・Result of Joint Monitoring ・ Procurement and Installation Plan of the Equipment for Monitoring System ・Monitoring result of the JICA Monitoring Survey Mission
4th	At the time of Project Monitoring in May, 2019	・Result of Joint Monitoring ・Monitoring result of the JICA Monitoring Survey Mission
5th	At the time of project completion, scheduled in May 2019	・Result of Joint Monitoring ・Monitoring result of the JICA Monitoring Survey Mission

(4) Weekly Meeting

As a rule, PIM meetings are held basically at the end of every week and the activities for the week

are reported, the activities scheduled for the following week are confirmed and pending issues, matters of concern, requests, etc., are discussed. The meetings are also utilized as a venue for training through seminars and workshops on matters proposed by the experts, etc. Meetings have been held seventu times as of the end of February 2019 (including thirty times in Phase 1).

(5) Project Progress Report (Part 1)

Project Progress Report (Part 2) was submitted to JICA and WASAC at the end of June 2018 and in August, respectively.

1-2-2: Training in Japan and in the 3rd Country

(1) Training in Japan

Table 1.10 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5	- Introduction to water service management and NRW - Outline of water facilities in Yokohama and Kobe Cities and other matters
2	August 14 to 30, 2017	Business affairs and GIS matter	5	- Introduction to water service management and NRW - Customer information management, meter management and reading, and water service management - Examples of how local governments utilize GIS, purposes of use, and other matters
3	Nov. 13 to 30, 2017	Technical matter	5	Introduction to NRW, pressure management, leak detection, distribution management, and other matters

(2)　Training in the 3rd country

Training in the 3rd country was conducted in Kenya as shown in the table below.

Table 1.11 Training in the 3rd country

No	Timing	Field of training	Trainees	Training Themes
1	May 7 to 10, 2018	Management Team	2	An introduction and discussion of activity on NRW reduction carried out in each other's countries.

1-2-3: Activities of Output

【Activities of Output 1】:

Planning capacity of NRW reduction of WASAC is enhanced.

1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.

The member of the management team and action team were appointed formally and teams were organized in August 2016 by CEO, but CEO of WASAC Mr. James Sano retired on September 1, 2017, and Mr. Aime Muzora who was a director of MININFRA took office as a successor. Following this,

there were personnel changes and the resignation of the WASAC staff in September and had the effect in a management team and action team partly.

a. Management Team

The directors of commercial and financial departments resigned, and successors took office.

Table 1.12 Movement of Management Team

Section	Predecessor	Acting	New appointment
Director CS	Lucien Ruterana	Felix Gatanazi	James Mwijukye
Director CFO	Joseph Ruhinyura	Samson Hategekimana	Ceaser Nkusi Nkwesi

c. Action Team

There was the transfer of two directors of Gikondo and Kanonbe, and five WDO of Kacyiru, Nyarugenge, Nyamirambo, Kanombe, Remera. But three peoples of the WDO are reliefed between the branches in the Kigali city.

Table 1.13 Movement of Action Team

Branch	Predecessor	New appointment
Branch Manager		
Gikondo	Mutamba Jane	Tuyisenge Vedaste (from Bugesera)
Kanombe	Aimable Ndagijimana	Mukiza Anaclet (from Nyagatare)
WDO		
Kacyiru	Claudien Ruwabuneza	~~Alexis Dushimimana (from HQ)~~ Patric
Nyarugenge	Damascene Nsengimana	Etienne Rutagengwa (from Remera)
Nyamirambo	Pierre Claver Mukimbiri	Noel Kanamugire (from HQ)
Kanombe	Antoine Muhawenimana?	Pierre Claver Mukimbiri (from Nyamirambo)
Remera	Etienne Rutagengwa	Damascene Nsengimana (from Nyarugenge)

1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

Problems and causes about NRW have been extracted in workshops which were held in succession in the first Phase.

Table 1.14 Process of Assess NRW Reduction Measures

No	Item	Implementation period	Details
1	Distribution of questionnaires to the 20 branches	Sept. 2016	Organization, outline of water supply facilities, customer information, NRW percentage, flow rate meters, water leakage investigation equipment, pipe repair equipment, water theft, water meters, etc.
2	Analysis of questionnaires	Sept.-Oct.2016	
3	Seminar	Nov. 8, 2016	on the questionnaire analysis results
4	Field surveys and reporting and issue identification at weekly meeting	Sept.2016 to March 2017	Confirmation of questionnaires, visits to facilities, interviews with branch managers, operators, etc., sharing survey results.
5	NRW strategic action plan workshop GP1	March 20-22, 2017	NRW reduction plan: Workshop on identification of issues

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

From the information obtained in Activity 1-2 and the survey of the 6 branches within Kigali City and the existing water supply facilities (field surveys, questionnaires, GIS, water consumption data), the issues were identified, and the countermeasures and orders of priority as of November 2016 were summarized.

Thereafter a series of workshops were held, based on the wishes from the WASAC side for more detailed investigation of the issues and causes. The framework of the 5YSP for NRW Reduction formulated through the workshops.

Table 1.15 Process of workshop for 5YSP for NRW reduction

No	Item	Date	Details
1	GP2	April 5-6, 2017	Workshop to analyze causes, formulate measures, and select components
2	GP3	April 21, 27-28, 2017	Workshop to compare and combine the issues identified by JICA specialists and the issues and measures identified by WASAC
3	GP4	May 5, 12, 15 and 22, 2017	Workshop regarding the selected components, formulation of order of priority of countermeasures, and establishment of framework
4	Seminar	May 29, 2017	The framework for the 5-year Action Plan for NRW Reduction was approved
5	GP5	August and September, 2017	Formulation of specific action plan for corresponding measures. Preparation of Final Draft Report of 5YSP
6	GP6	October 4, 2017	Joint workshop (management team, action team, 6 branch managers), discussion of Final Draft

In the table, the methods of dealing with issues were grouped, forming 5 main compornents and grouped in 42 countermeasures (133 specific actions), to form the main components of the 5YSP. These were classified based on the International Water Association (IWA) water balance table.　Also the year of implementation and sections responsible were formulated. The framework for the 5YSP was approved by the seminar held on May 29, 2017.

1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

The inventory survey was carried out by the GIS team of WASAC, and the preparation of the schematic layout drawing of the distribution reservoir facilities was completed in October, 2017. However, as a result of on-site verification of the results, many deficiencies were recognized and the work need to be performed a second time because the results would not withstand actual use. It is desirable that this work is performed in the 5YSP activities.

1-5　Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP.

The final draft report of 5YSP was completed in the end of September, 2017, and the report was discussed in the workshop which called a branch manager and the main staff of the Kigali city 6 Branch on October 4. With that in mind, in the second SC held on October 12, 2017, under participation of MNINFRA and the management team and the action team of WASAC, common knowledge and the agreement formation of 5YSP (Final Draft) was planned between all related sections. Afterwards, furthermore discussions were carried out mainly by NRW unit to make it practice, and a monitoring plan of implementation of 5YSP was added.

- Workshop　：October 4, 2017
- Steering Committee　：October 12, 2017

1-6　The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

WASAC management recognized the importance of the institutional reorganization and currently the structure is been revised by senior management. This new structure is also intended to enhance NRW management mainly by emphasizing on some activities such as data analysis, water leak detection, water leak repairs, etc., which is insufficient at present.

1-7　The management team prioritizes and schedules the conducts of specific actions of 5YSP

The yearly implementation schedule of each specific action was prepared. As a future issue, it is required the detail action plan including the procurement of the logistics (survey, repairing, vehicle etc.) at each section of the head office and branch offices.

The specific action in 5YSP which is able to be performed in the annual action plan of each branch will be implemented sequentially for the time being.

Project manager and a JICA expert visited all 20 branches from early April to early July of 2018 to explain contents and the templates of monthly report of 5YSP.

1-8　WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.

The budget for the financial year (2018/2019) was scheduled to be added and amended with the

approval of the 5YSP Report by the WASAC Board. There is not influence in particular about the implementation for the time being, because most of the activity for NRW reduction was in the normal budget (Utility Budget: Flow expense and OPEX: maintenance expense)

1-9　The management team prepares the 5YSP that summarizes the achievements from Activities 1-1 to 1-7.

The management meeting collected all managers of DUWSS, all section heads was held on November 14, 2017, and the latest edition of the report was explained. It was decided to change its name from "5-year strategic action plan (5YSAP)" to "5-year strategic plan (5YSP)" in the meeting. A result was reported to CEO and each Branch Manager on the next day.

A report was submitted to the Senior Management Team by the project director Mr. Methode on December 15, and the report was approved in the Senior Management Meeting held on February 12, 2018.　5YSP was finally officially approved by the WASAC Board of Directors on April 27, 2018. After responding to the comments received, the final approval of the WASAC Board of Directors was obtained on April 27. Implementation of the plan has been delayed by one year relative to the schedule, and will be commenced in fiscal year 2018/2019.

1-10　The management team holds seminars and presents 5YSP (Activity 1-8) for WASAC and other concerned parties.

5YSP was shared with the relevant persons in MININFRA and WASAC at the SC meeting on October 12, 2017.

1-11　The management team facilitates implementation and the monitoring of the 5YSP.

- A monitoring team consisting of five senior managers has been appointed by WASAC CEO on September 3, 2018 to carry out monitoring of the implementation of the 5YSAP.
- The implementation situation of 5YSP at each Branch is monitored by the quarterly report from the Branch.
- A report of Q1 (from July to September, 2018) was submitted in November, and monitoring result was reported at the seminar held in a galaxy hotel on December 7.
- A briefing session for the CEO was held on January 7, 2019.
- The report of Q2 (from October to December) is in evaluating contents. It was decided that 20 branch are shared to four groups, and let them report it every month in Kigali.
- Leakage survey into transmission pipe and main distribution pipes of the up-country branch are continued such as Rubavu, Musanze, Musanze, Ruwamagana, Huye, Nyagatare.

1-12　The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.

It is going to be carried out as a part of the activity of 3-18.

1-13　The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

5YSP is updated as necessary based on the result of the Pilot Projects.

1-14　Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

It is scheduled for May 2019.

【Activities of Output 2】:

Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2-1 Training materials on NRW control are prepared.

The training materials (text, presentation materials, etc.) in each field were prepared at each time.

2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.

Awareness of NRW management has been deepened by implementation of training in Phase 1, and, through the series of workshops held in the process of formulating the 5YSP.

Table 1.16　Output of Training in NRW Management

Required Capacity	Training Item	Achievements and Challenges
Understanding of definition of NRW and components of NRW	General items	Sufficient understanding of the components of NRW, in accordance with the definitions of the IWA.
Preparation of NRW reduction action plan	5YSP	Understanding of the details of countermeasures and activities through the process of study of the preparation of the 5YSP.
Implementation, management and monitoring of NRW reduction action plan	5YSP	Preparation of activity monitoring report format.
Evaluation of NRW reduction activities	Pilot Project capacity (Cost-benefit analysis)	Implementation of training in accordance with the progress of the Pilot Project.

Analysis of NRW components	Pilot Project capacity (Water distribution analysis)	Implementation of training in accordance with the progress of the Pilot Project.
Preparation of NRW reduction measures manual	Pilot Project capacity (Implementation manual)	Implementation of training in accordance with the progress of the Pilot Project.

2.3 OJT is conducted on the updating of GIS data, using available GIS data base.

Training relating to updating of GIS data has already been completed (Phase 1 August to November 2016). The timing of development of WASAC GIS data (pipe network data, customer data) by ESRI and introduction of software (ArcGIS) was unclear, so it was not possible to commence specific activities using ArcGIS. In addition, the GIS Team has comparatively high individual skills in the use of the ArcGIS software, but the organization itself cannot fully utilize the software. As the results of implementing the training as indicated in the following table based on this situation, the WASAC staff involved in the work regarding GIS fully understood the processes of setting for updating the GIS data and know-how in connection with these operations.

Table 1.17　Output of Training in GIS

Required Capacity	Training Item	Achievements and Challenges
GIS data updating (customer data, pipe network data)	・ Continuous updating of GIS data (customer and pipe network data, new customers) ・ Updating data using Manuals (GIS Procedure Guide and GIS Operation Manual)	Degree of achievement: B Training was carried out into reassessment and improved efficiency of the current flow for updating in WASAC, using usable data. The staff understood the skills and techniques necessary for updating of data. In the future, it will be necessary to change the updating procedures in accordance with circumstances, such as completion of the ESRI work, etc., but the staff will be capable of dealing with these. The target of the technology transfer was only 5 members of the GIS Team, but the technologies can be spread to other members by utilizing the manuals that have been provided.
Sharing and practical use of GIS data	・ Utilization and sharing of GIS data in WASAC ・ GIS data sharing by QGIS and Google Earth ・ Use of drawings created using GIS	Degree of achievement: B Training in utilization and sharing was carried out for a total of 20 members of staff for whom there is a possibility that they will be involved with GIS in the future. The response of the staff members to the introduction of the QGIS data set was good and significant. There were major advantages in that each member of staff could immediately look up elevations, etc., on their PC, and in addition, there is the awareness effect that they will become familiar with the use of GIS.
Transfer of applied technology related to layout and data analysis by ArcGIS	・ Method of preparation of "data-driven pages" ・ Method of constructing and analyzing an [ArcGIS Geometric Network], for analyzing pipe networks using ArcGIS	Degree of achievement: B These two applied functions of ArcGIS were introduced to 2 or 3 members of the GIS team, and an extremely good response was obtained. On this occasion, it was not possible to provide instruction on these functions to the practical use level, but it can be greatly utilized in the work of the staff in the future.

Notes)　A：The training target has been sufficiently achieved, and activities can be carried out systematically without problem.

B: The training target has been virtually achieved, and if there is a wish to implement the plan at management level then there is the potential for systematic development.
C： There is a moderate level of achievement, and with the accumulation of work experience in the future, there is a prospect of development at the individual level.
D: The degree of achievement is insufficient, and further training is necessary.
E： There is no potential for growth.

2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

The training was carried out in Phase 1 from August to November 2016. Before this, there were no personnel or departments within WASAC with experience of hydraulic analysis. Moreover, as a result of the delay in developing GIS data, software dedicated to hydraulic analysis (Mike Urban) has not been licensed and introduced. Therefore, training was carried out on the basic theory and using alternative software, for C/P personnel responsible for GIS and design having the role of constructing DMA and that are expected to utilize software in the future.

Table 1.18 Output of Training in Hydraulic Analysis

Required Capacity	Training Item	Achievements and Challenges
Understanding of purpose of use of hydraulic analysis	・Understanding and purpose of hydraulic analysis (What to do with hydraulic analysis？)	Degree of achievement: C The vision of hydraulic analysis goes beyond each of the individual components of the technology, so it is substantially advanced and difficult. It is difficult to become proficient through lectures, and even if there has been two-way discussion, ultimately each individual must diligently gain insight.
Understanding of general basics of hydraulic analysis	・Basic knowledge of hydraulic analysis ・Understanding of Hazen-Williams formula	Degree of achievement: B The general basics of hydraulic analysis have been understood. However, the amount of practice is insufficient, so the ability to apply it to practical work is insufficient.
Handling of existing data (GIS, water consumption) required for hydraulic analysis	・Flow of data in WASAC and handling of data ・Quality of data and reliability of hydrological analysis results	Degree of achievement: C Repeated lectures were given on the organized flow of data in WASAC. The analysis practices were carried out using actual data in order to demonstrate to WASAC staff how difficult it is to achieve success. Degree of achievement: B The importance of the quality of data has been understood. However, this is a long-term organizational issue, and is not a problem that can be immediately solved by the GIS Team alone. Whether or not WASAC can construct an effective data collection system remains to be seen.
Understanding of ways of using hydraulic analysis software	・How to use EPANET ・How to use simple conversion application to join EPANET and WASAC GIS ・How to use Mike Urban	Degree of achievement: A Regarding the methods of use of hydraulic analysis apps with EPANET and Mike Urban, staffs have been using PCs for a long time, so they quickly became proficient in the use of analysis apps. Staffs have become proficient in the basics and manuals have been provided, so in the future they will be able to proceed with practical examples while investigating on their own.

2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

Water volume control and water pressure control are important items for water leak control. In the case of water volume control, the amount of water leakage in the water supply pipes and main distribution pipes can be generally determined by measuring the flow rates in pipeline segments using exposed pipes such as raised aqueduct or pipes attached along a bridge. It is also possible to determine the amount of water leakage by measuring the Quantity Minimum Night Flow (Qmnf) of a distribution pipe network at each DMA (District Metered Area), and to narrow down the location of the water leak by carrying out a step test or direct measurement on the pipeline (modified step test).

Table 1.19 Output of Training in Leak Detection

Required Capacity	Training Item	Achievements and Challenges
Leakage point detection work	・ Capable to understand water leak surveys/functions of leak detector, and to operate the equipment. ・ Capable to understand the general basics of the method of detection of sound source for water leak detection. ・ Capable to understand purposes of water leak surveys, purposes of use of detector, as well as to choose suitable equipment in accordance with the circumstances on site. ・ Capable to choose the equipment suitable for sound source detection on metal pipes, non-metal pipes, small-diameter pipes, large diameter pipes, distribution pipes, and water supply pipes.	Degree of achievement: B There are no problems regarding the use of water leak detector, but further proficiency can be expected by further efforts through practical work. The trained staff can provide training to other members of staff. There are no vehicles only used for surveys, and the survey system has to be put together ad hoc. This technology is still new and requires time for the team to get more experience. The number of staff in WASAC dedicated to leak detection is low. The complexity of the site (not always paved road and not well known network). Some equipment (correlators) are not fitting with the majority of WASAC existing network condition.
Water volume control	・ Capable to carry out continuous measurement (monitoring) over a long period using a data logger. Capable to understand the basic of signal measurement. ・ Capable to collect and visualize flow rate data before analysis. ・ Capable to conduct surveys of water leak amount by the nighttime minimum flow rate method. ・ Capable to determine important zones for water leak detection by sub-zone step tests and direct measurement. ・ Capable to estimate water leak quantities between two locations by measuring the flow rates at some different points.	Degree of achievement: B The theory of measurement and methods of use of ultrasonic flow rate meters have been understood. The trainees identified the water leak quantities by measuring the nighttime minimum flow rate and carrying out a step test on the WASAC pipeline and confirmed the effectiveness of the method of tracking the area where the water leak exists, as well as understood how to carry out these operations. They are now capable of using these methods in practice on their own judgment.
Water pressure control	・ Capable to carry out continuous measurement (monitoring) over a long period using a data logger. Capable to understand the basic of signal measurement. ・ Capable to collect and visualize water pressure data before analysis. ・ Capable to understand the basics of water pressure data signal measurement. ・ Capable to understand the relationship between high water pressure and NRW.	Degree of achievement: C The general basics of measurement and the method of use of water pressure gauges were understood. Monitoring can be carried out using a data logger. In undulating topography, there are many areas with excess pressure, but dynamism and motivation of trainees are insufficient for active risk management.

Formulation of plans for water leak detection operations	・ Capable to understand water leak surveys and detection methods and choose effective methods in accordance with the circumstances of the water distribution pipe network. ・ Capable to understand the relationship between water pressure and flow rate. ・ Capable to evaluate the distribution pipe network, make judgments of what part is functionally impaired, and formulate improvement measures. ・ Capable to elaborate plans of water leak surveys with awareness of the 5YSP.	Degree of achievement: D The ability to formulate water leak survey plans for water distribution networks has not been achieved. In order to carry out an effective water leak survey, it is necessary to form DMAs in the distribution network, and as such, a more detailed study should be carried out for appropriate layout of reservoirs, etc., and development of distribution network. It is necessary to select areas available for water leak surveys, and it is needed to carry out work to hydraulically isolate the area.
Maintenance of water leak detector	・ Capable to decide on the storage location of the equipment, and to store the equipment in an orderly manner. ・ Capable to appoint a person responsible for the storage, in order to prevent loss of equipment, and to maintain records of issuing the equipment. Capable to carry out minor maintenance such as replacement for poor connection of dry or other batteries.	Degree of achievement: D One room in WASAC Headquarters is used for storage of the equipment, but the space is narrow, and the arrangement is not tidy. A control record register has been prepared for issuing equipment, but it is not being properly used. A person responsible for maintenance has not been appointed. The point of contact for repairs whenever there is a breakdown of equipment has not been determined.

WASAC did not possess the practical techniques for systematic measures against losses, but as a result of this training, members of staff of the NRW Section have learned the methods of using water leak survey and detection equipment, and the methods of carrying out surveys and detection using this equipment. In particular, through the activities of the Pilot Project, WASAC has acquired the techniques of detecting invisible water leaks, which it could not achieve previously, and this is a major breakthrough. The invisible water leakage as a percentage of the NRW in the WASAC water distribution network is extremely high, and it is expected that these techniques will contribute greatly to the NRW reduction activities of WASAC.

The training enabled WASAC to have the minimum necessary equipment for water leaks survey and detection, and to foster technicians capable to carry out water leak survey and detection, although the number of them is small, so in the future it will be necessary to extend this practically to specific activities in the WASAC branches.

The NRW Section does not systematically plan leak detection work. It is desirable that an overall plan be formulated in accordance with the 5YSP for the activities of WASAC as a whole, while utilizing the experience accumulated in the Pilot Project of this Technical Cooperation Project. To this end, it is necessary to create an implementation mechanism by carrying out reorganization at Headquarters or at branch level, for carrying out survey and detection.

The training by the JICA expert is finished. In the activities in the pilot areas, the training result (leak age survey, leakage detection) of the WASAC staff is shown. The pilot project practices the technique that they obtained, and it is an opportunity to improve it more.

2.6　In-room training and OJT on repairing leaking pipes and installing service connection for

the pilot project are conducted.

The training in this field was mainly carried out for members of staff in the branches, so the six branches in Kigali were visited sequentially, the status of work was closely examined, and OJT was carried out on methods of installation of water distribution pipes.

The majority of locations where water leaks occur are on tertiary or service pipes. Therefore, the emphasis in training was put on the following points in installation, and training was provided in thermal welding of HDPE pipe, proper hole drilling using drills (non-water supply suspension cutting method), proper cutting of screw treads using dies, methods of wrapping Teflon tape, measurement of water pressure and measurement of residual chlorine after drilling, backfilling of pipes, etc.

- When a branch is formed from a water distribution pipe using a saddle, a hole is formed in the water distribution pipe using a heated steel rod. High pressure occurs, if the hole is too small, which causes damage to the saddle packing and cracking on the pipe wall.
- PVC pipe or HDPE coils are joined by forming screw threads. Therefore, the pipe wall pressure is reduced.
- When cutting screw treads (with a die), water is used and not oil.
- Sealing tape (Teflon) is wound too much. The screw threads do not come into close contact because of this excess of winding, which causes division at the screws. Moreover, workers do not peel old sealing tape, but wind over it.
- The chippings of pipe material that occur after pipe repair are not removed, mud that falls into the pipe during operations is not removed, and connections are made while this remains. Pipe cleaning is not carried out. This causes blockage of meters.
- The pressure resistance of pipe material is not uniform when a mixture of PN16 and PN10 is used.
- The quality of the pipe material is poor, so longitudinal splitting of PVC and HDPE pipes occurs due to high water pressure.
- After carrying out a repair, water is not applied in order to check whether there is a water leak.
- Vehicles are driven even on small, unpaved roads, which can cause damage to pipes due to insufficient depth or inappropriate backfill. The excavated soil such as clay in which consolidation settlement can easily occur or gravel is used as backfill, and this can cause new pipe cracking and water leakage. Sufficient compaction of the pipe foundation is not carried out, and this causes water leaks.
- Procurement of pipe materials and excavation of the pipe route for laying these pipes are carried out by consumers, and quality is not ensured.
- When carrying out water leak repairs or connections of a new water supply pipe, there are no valves nearby so it is not possible to shut off the water, and this causes lost water.

2.7　In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

In the Pilot Project, emphasis was placed on the accuracy of the customer meters used as the main

cause of the apparent loss of NRW, and on-site calibration of the meters and replacement of the meters in accordance with the result was carried out. At WASAC previously meters were only replaced in the event of a breakdown, and assessment of accuracy on the WASAC test bench was only carried out when the meter had been procured and when there was a complaint from a customer.

As a result of the activities of the Pilot Project, the following issues became apparent, and training in methods to deal with these was scheduled to be continued by OJT.

1) Appropriate processing of data on water consumption amount (occurrence of NRW in the process of water metering and consumption)

- When a meter was replaced, the amount of water used between when the meter was read and when it was replaced or the estimated amount of water was lost in terms of accounting. Correction of the programming of the CMS system for customer data management is required.
- The criteria of the method of estimating the volume of water consumption when it was not possible to read the meter are unclear.

2) Establishment of methods of analyzing customer data

- The purpose of monitoring and analyzing the quantity of water consumption for each customer is not recognized (detection of abnormal data, water consumption volume processing errors, meter faults, detection of suspected theft of water, etc.)
- A database for analysis of customer data has not been prepared. Even though there is GIS customer data and Commercial Services Department customer data, they have not been linked, so their uses are limited. Therefore, it is an urgent task to prepare a unified database for all branches.
- There is no manual for the methods of analysis of customer data. Almost all of those responsible in each of the branches are beginners in the use of Excel and Access software, and at present are occupied with basic operations such as data input, calculation, etc. In addition to improvement in basic capabilities, it is necessary to provide training to improve the capabilities of the members of staff to deal with data modification, cross tabulation, methods of detecting abnormal data, preparation of graphs, determining customer properties, and other simple analysis methods.
- The operability for processing a large amount of data with the Excel software is limited, and the potential for making a mistake is large, so it is desirable that this is dealt with by programming such as a Customer Management System (CMS), etc., as the method for processing and analyzing complex customer data.

3) Meter calibration method, and establishing criteria for replacement of meters

- Customer meters with problems in measurement accuracy (about 20% of all customer meters) are used over the long term, and are left as they are.
- From the lessons learned in Pilot Project 1, the criteria for the calibration operations on site using a simple test meter were reviewed, and it was planned to implement them in Project 2. At the same time, the criteria for meter replacement were justified based on the calibration results.

4) Allocating POC numbers to customer addresses

- A POC label (seal/metal plate) is applied to the customer residence.
- Preparation of POC map (plotting on GPS map, conversion to GIS data).
- In order to automatically add the POC of the new customers that are increasing every month to the pilot area (DMA) customer list, a DMA code for the pilot area is allocated to the POC data of the CMS.
- In order to link to the GIS customer data, it is necessary to collect the required customer data at the same time as the new customer contract. It is necessary to create a system to be implemented responsibly by a branch WDO or a technician.

5) Dealing with disconnection, and abandoned public water taps

- In the case of customers for whom measures have been taken to stop their water supply, the risk of illegal use of the water supply increases, so it is necessary to carry out tracking surveys after taking measures to stop their water supply. As the survey method, interview surveys for each household are proposed in order to confirm the local situation and the items required for each customer, etc.
- Since water supply to a public water tap is suddenly interrupted because of non-payment of charges (2 weeks or more), many customers act repulsively, and there is a strong possibility that it can cause illegal use and illegal connections, etc. Even if there is a need to stop the water supply, sufficient care should be taken with respect to the users.

The training by the expert is finished. In the pilot project activities, the training result of the WASAC staff is shown.

2-8 Training materials on NRW are reviewed and updated.

Updating will be carried out through implementation of the pilot project of Output 3, after February, 2019. Training materials will be reviewed and updated based on the result that practiced in the pilot project activities. I become a manual in 3-18.

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

The development of the programs and training courses will be planned by May, 2019. These should be incorporated in a training plan in Supporting Service Department (SSD) and be intended it for all branch personnel.

【Activities of Output 3】

: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

A. Project Preparation

3-1　The action teams are organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.

The counterparts were formally appointed by the CEO, and formation of the Action Team was completed in August 2016. However, as stated previously, there was relocation of personnel in September 2017, and this had some effect.

3-2 The action team grasps the current situations of Pilot Area 1 and Pilot Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.

Selection of two pilot areas (Area 1: Kadobogo of Kacyiru Branch, Area 2: Ruyenzi of Nyarugenge Branch) from the proposed candidate sites in September 2016. Information data of two pilot areas were collected in September 2016. Afterward, information data of pilot areas such as POC list and boundary were updated.

1)　Pilot Area 1

Customer list (POC: Point of Connection) and the POC location map of the pilot area (Kadobogo) were provided from the Kacyiru Branch and GIS section respectively. However, in local findings through the site work such as onsite meter test and leakage inspection, it became clear that some POCs which did not match with the local situation were included in POC list and/or the POC location map, and adversely, the POCs which should be existed in the area were not included. This correction took long time because of the difficulty to confirm POC number onsite.

It was decided that the NRW rate which has been calculated so far at each sub-zone are reviewed again after a list of POC were revised. As a lesson, preparation of a list of POC and the POC location map are basics of the project work. These are extremely important information to conduct the routine onsite work of WASAC such as meter reading, meter test, meter investigation and leakage survey. It was proposed to stick the seal which displayed a POC number on the gate of each house

2) Pilot Area 2

The customer POC number survey was carried out on site in March and April 2018 collecting positional coordinate data using mobile GPS. Based on the results, the POC positions were input onto

GIS distribution pipe maps that were prepared superimposed on Google Maps, to produce the POC position maps. Based on these maps, the operation of confirming the hydraulic isolation in areas and zones within the areas was carried out, to determine the boundaries. In the course of this work, the POC list and the POC position maps were readjusted.

Based on the lessons learned from Pilot Area 1, in Pilot Areas 2 it was decided to apply the POC seals prepared in the Project to the customer residences. It was also decided to investigate methods of taking high-pressure reduction measures prior to carrying out the measures against actual water leaks. The implementation policy was as follows.

- Calculate the baseline NRW rate value based on the POC list completed at the end of April 2018.
- Carry out continuous calculation of the NRW rate every month.
- Install PRV after studying measures against high pressure and verifying the positions to install PRV. Carry out water pressure measurement for this purpose.
- Set tertiary pipe areas in three locations for analysis of water distribution rate, and measure the nighttime flow rate.
- Conduct a meter survey at all customer locations, and implement meter calibration in selected locations.
- Replace defective meters with new ones.
- Conduct a minimum nighttime flow rate survey and step tests in each zone.
- Detect water leak locations and carry out repair work.

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Pilot Area 2.

A work plan of pilot project for area1 and Area 2 was prepared.

3-4　The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1and 2.

Construction of chamber and installation of the measuring equipment in the chamber has completed in May, 2017.

3-5　The action team establishes the baseline NRW rate of Pilot Area 1 and Area2

The boundary reconfirmation and correction by the hydraulic isolation work was made in December, 2017. The measurement of the inflow of pilot Area 1 was started in June, 2017 and NRW rate of each month have been calculated. However, about baseline of NRW, it was reviewed after the correction of the POC list.　As the baseline the mean of 2 months June and July, 2017 with 37.3% was adopted.

Targeted value in the project was decided to 20%.

Because the measurement of the NRW rate was enabled in pilot Area 2 from March, 2018, the NRW baseline level was decided with 68% which were an average NRW rate in March and April. In SC held in August 2018, 25% were decided as the NRW reduction targeted value.

B. Activity of the Pilot Area

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1 and Area 2.

The activity in pilot Area1 was completed by June 2018. The result was reflected to an activity plan of pilot project 2 such as customer questioner survey and customer meter survey.

In pilot Aria 2, on-site meter test was carried out for 413 big customers (the customer that consumption of more than 20m3/ month is recognized more than once for continuation three months) in all customers (1,705) and finished this work by the end of November, 2018. As a result of this test, 86 meters which have more than ±5% of the tolerance and 53 faulted meters were replaced between the beginning of December 2018 and the end of January, 2019.

3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness

1) Pilot Area1

Because there was a difficulty to evaluate an effectiveness of the customer meter replacement at a monthly NRW rate, so the evaluation by the comparison of the error mean before and after the meter replacement by using the error result of a measurement to total number of the tested meters. And the evaluation by the comparison of the total consumption before and after replacement of meters.

The result of error average shows that improvement value is only 0.7% of the negative side. The tendency that consumption after the replacement rises a few is seen, but it is a comparison of a half year before and after the replacement, and the judgment of the effect is difficult because used volume of water of each customer change belonging to his requirement month by month. In conclusion, it may be said that the direct effect to the whole area by the meter exchange is minute.

2) Pilot Area 2

In pilot Area 2, the measurement of the meter for big customers was carried out from July, 2018

through November and finished meter replacement afterwards by January, 2019. A comparison result of mean meter error before and after replacement shows that errors increased in the plus side 0.19% because the correction quantity of the error of the plus side was bigger than a negative side. It shows that financial profit may be adversely affected by the meter exchange.

3-8　The action team conducts measures for reducing surface leakage (visible leakage).

3-10　The action team conducts measures for reducing underground leakage (invisible leakage).

3-12　The Action team conducts measures for reducing high water pressure.

1) Pilot Area 1 (Kadobogo)

Leakage survey

Leakage detection work in pilot area 1 was finished once by August, 2018 and continue the periodical monitoring of the NRW rate monthly. Because it became clear that leakages frequent continuously even if repair performed when high pressure control measures did not take, the pressure reducing valves (PRV) are set up in the inlet points of PM2 and PM3 for high pressure control measures in September 2018. And the measurement of the NRW reduction effect was performed in October. The effect of PRV was confirmed by measuring Qmnf (leakage approximation quantity) when pressure reduction rate of PRV changed gradually.

Setting of PRV of PM1 was decided on January 17, 2019.　The PRV of PM3 was replaced because of its leakage.

Step test in nighttime was carried out as a leakage survey in PM3 on February 6, 2019. The Qmnf change with small volume such as 3.32m3/h in November, 2.91m3/h in December, 4.71m3/h in January, 3.53m3/h in February and it is stable relatively after the PRV setting. Because of a sign of the leakage reoccurence is not seen, the further leakage survey is canceled.

Pipe replacement

The delivery of materials for pipe replacement in Kadobogo PM1 to the Kacyiru Branch was completed on December 20, 2018. A meeting about the preparation of the work plan for pipe replacement was held in Kacyiru Branch on January 23, 2019, and joint site surveyed was conducted on January 25. On-site work was started on February 4. The completion of the work is expected in the beginning of March, 2019. The work is carried out in line with the WASAC standard (Requirements for Water Distribution and House Connection). This standards, as a management standard, may be reviewed by lessons getting from this pipe replacement work. The step test in nighttime was carried out on February 6 to get a

baseline value to observe the effect of the Work.

In sub-zone PM1, repair works are carried out every month, but NRW reduction effect is not seen. In PM2 and PM3, NRW reduction effect is remarkably seen after repaired the pipes which were found invisible leakages and high pressure control was done by installation of PRVs.

2) Pilot Aria 2 (Ruyenzi)

First priority to high pressure control was given by a lesson of Area 1. It was decided that on-site customer meter test, meter replacement, leakage survey and repair of leakage pipe are performed in order after high pressure control.

Based on this policy, Manhole construction and setting of PRV in it has started in August and three places (PRV1 and PRV3 in RY3, PRV2 in RY2) of setting was completed by November 7, 2018. Effect measurement of these three places were carried out by the end of October. Sequently, PRV effect was evaluated by NRW rate before and after pressure adjustment by PRV in the small DMA (A2) for four days from January 28 to February 1, 2019.

The measurement of Qmnf in Area 2 was carried out on December 3, 2018. Step test was performed in the night of February 13, 2019.

In the area of RY3 (water supply area of the Gihara reservoir), the survey should proceed so that stable water supply is enabled. The setting of the float valve to a BPT in RY1 on January 24, 2019 was done.

3-9　The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

3-11　The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

3-13　The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.

NRW rate is calculated every month from June 2017 in Area 1 and from January 2018 in Area 2.

1) Pilot Area 1 (Kadobogo)

The NRW rate of January, 2018 fell to 10.6% and achieved 20% of targeted value of the Project. It is clear that an NRW rate decreases continuously from about April, 2018 when it is looked with the movement mean of 3 months. It seems that an effect of leakage repair and an effect of the reduction of the high pressure that got into full swing from that time are shown.

2) Pilot Area 2 (Ruyenzi)

The NRY rate of January, 2019 reduced it by 5.1% from last month, and it became 52.5%. It seems that an effect of PRVs which were established in last November is shown. However, it is still too high, and the far situation for 25% of the Project targeted value.

The main activity in both pilots area continues to be finished by April and makes the generalization (report, manual) of the project. Even though the NRW rate of Pilot Area 2 was not able to fall to below 25% in April, WASAC should continue their challenge in order to achieve the Project target.

3-14　The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.

The contents which carried it out by a pilot project so far are reviewed and summarized and analysis is planned in April.

3-15　The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.

The implementation in May 2019 is planned.

3-16　The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.

The implementation in May 2019 is planned.

3-17　Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.

It is during enforcement parallel to pilot area 1.

3-18　Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

3-19. Action team disseminates the manual and use of survey equipment to the activity of whole branches.

It was decided that the manual development team is set up in WASAC, and the team push forward making in collaboration with JICA expert. A manual preparation meeting (kickoff) was held on January 29 and February 5, 2019 and confirmed follows.

- ✓ A purpose:

To show the appropriate procedure to be used in each NRW reduction activities based on what have been done in pilot area and their implementation though WASAC-JICA project.

- ✓ Aim of use: The achievement of the five years strategic planning
- ✓ User : All WASAC staffs
- ✓ Use time : At the time of start of each activity
- ✓ Making method: I make an each work manual the one which I gathered up
- ✓ Making time limit : May, 2019

It continues next for fourth year.

【Activities of Output 4】:

4 branches in Kigali establish the system to measure NRW rates accurately.

4-1　Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

Four branch separation boundary lines were established by the end of September, 2016. The review of the hydraulic isolation plan is completed in the 1st Phase. About the decision of the boundary of 4 branches (Nyarugenge, Gikondo, Kacyiru, Nyamirambo), a close inspection was made by the collaboration with a WASAC GIS team, WDO of the branches and the JICA expert team.

The result of the close inspection was discussed in a project management meeting of October 7, 2016, and the position of the boundary line was settled.

As a result, there is the boundary position correction between existing branches to some extent, and the adjustment between branches of the customer registration with it is required.

The number of the movement of the customer between the branches is almost just what to show it in table below. The adjustment work on the customer registration list will be performed together in the process of equipment procurement schedule for the construction of hydraulic isolation systems.

Table 1.23 The number of the movement of the customer

Before movement	After movement	Customers
Kacyiru	Gikondo	4
Kacyru	Remera	15
New Nayrugenge	Kacyiru	11
New Nayrugenge	Namirambo	435
Gikondo	Remera	1314
TOTAL		1779

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

The flow rate monitoring system for measuring the amount of water distributed to each branch in order to calculate the NRW consists of devices for measuring data (flow rate, pressure) installed on site, and data collection equipment installed at WASAC Headquarters. The data measured on-site is transmitted to the data collection equipment via a mobile telephone transmission network (GPRS). The data collection equipment is a server that carries out data collection, accumulation, and display. However, its scale is the minimum necessary, and it does not include software for analysis and statistical processing of the collected data, or preparation of graphics. The data information is in text format, so WASAC process it in an Excel table, and calculate the NRW rate for each branch.

In addition, the system of the SUSWAS project (27 places of electromagnetic flowmeters) is to be compiled into the system of this project.

The review of the hydraulic isolation plan has completed and the locations to install an electromagnetic flowmeter and pressure gauge were determined in the joint meeting held between NRW, GIS and O&M team on October 31, 2016.

4-3. Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.

In process

4-4. Chambers are constructed as appropriate.

Among 23 places of concrete chambers to install procurement equipment in it, the chambers of 22 places are completed at a stage in the end of April, 2018.

Table 1.24　Status of construction of the Chamber（As of the end of February 2019）

No. of Chamber	Status	Note
M1、M2、M4、M5、M6、M12、M13、M15、M17、M19、M23	Completed on May 25, 2017	1st Phase
M7、M8、M9、M10、M11、M14、M16、M18、M20、M21	Completed on August 3, 2017	2nd Phase
M22	Completed on October 13, 2017	2nd Phase
M3	Completed	2nd Phase

- The tender for procurement of the monitoring system equipment being implemented by JICA was officially announced on May 26, 2017, but the business conditions of the tenderers were not good enough and the technical specification of the equipment did not satisfy the requirements, so in October 2017 it was terminated unsuccessfully. Thereafter, JICA Headquarters decided to carry out a re-tender, and at present, tender preparations are being made in Japan. It was decided to implement a lump-sum contract that includes the installation work.

- The overall procurement schedule is delayed by about two years from the Plan of Operation (PO) decided in RD.
- Regarding the details of the equipment, time has passed since the local tender was carried out in May 2017, so a survey was carried out again regarding the local situation. JICS made a supplemental survey for review the technical conditions for preparation of Tender Document between September 10 and 21, 2018 in Kigali.
- The monitoring system is expected to complete by the end of November, 2019.???

4-5. System input to each of 4 branches is measured.

The measurement of distribution volume in each branch will be started after construction of monitoring system. It is expected that the measurement of the quantity of water distribution in each branch in the Kigali city with the system will be conducted after November 2019. The NRW rate is calculate based on measured distribution quantity.

4-6. Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.

The calculation of NRW rate in each branch will be started after construction of the monitoring system.

1-3 Achievement of Output

Achievement status of the Project outputs is observed according to the PDM indicators. Refer to Project Monitoring Sheet I (PM Form 3-2).

1-4 Achievement of the Project Purpose

Project Purpose

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.

Objectively Verifiable Indicators

1. 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.
2. Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC.
3. The management at WASAC recognizes the effects of NRW reduction, and approves the budget of

each branch for implementing annual action plan for NRW water reduction

Means of Verification

1. 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure
2. Annual action plan of WASAC
3. Budget of WASAC

5YSP for NRW reduction was approved by the Board of Directors of WASAC on April 27, 2018. Afterward, the Action Plan should be approved by the Minister of Infrastructure. Action Plan of 6 branches in Kigali City should be reflected in annual action plan of WASAC. The budget for implementing Action Plan of 6 branches in Kigali City should be approved.

1-5 Changes of Risks and Actions for Mitigation

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

(1) Pre-Conditions

Table 1.25 Actions for Mitigation on Pre-Condition

PDM Pre-Conditions	Current Situation	Action for Mitigation
1 GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.	1-1 By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017. Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule. In the beginning of September 2017, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikUrban was made by Esri in the end of October 2017.	

(2) Important Assumption on Proceeding Assumptions (from Outputs to Project Purpose)

Table 1.25 Action for Mitigation on Important Assumption (from Outputs to Project Purpose)

Table 1.26 Actions for Mitigation on Important Assumption

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The non-revenue water section at WASAC is not subject to large scale reorganization.	1-1 Structure of WASAC was devised on March 2, 2017, but does not lead to the enforcement as of June 2017. On the project, it is thought that there is not the substantial influence. Movement of the GIS section to under the WOS unit.	
2 WASAC staff dose not resign after training by the Project.	1-2 Not applicable	
3 Large scale natural disaster does not occur.	1-3 Not applicable	

(3) Important Assumption on Proceeding Assumptions to Overall Goal

Table1.26 Action for Mitigation on Importance Assumptions (from Project Purpose to Overall Goal)

Table 1.27Actions for Mitigation on Important Assumption

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The Government policy on NRW remains as highly prioritized.	1-1 NRW still high priority	

1-6 Progress of Actions undertaken by JICA

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment was procured in July 2017.
- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is behind the schedule.

1-7 Progress of Actions undertaken by Rwanda side

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Preparation of 5-year Strategic Action Plan for NRW reduction.
- Joint visit JICA-WASAC of WASAC's upcountry branches.

- Training in Japan
- Training in the third Country

1-8 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

Other activity, problem

- ✓ Transfer of the monthly NRW rate calculation work of Pilot Area to WASAC
- ✓ Uptake to an NRW rate calculation of new customer data
- ✓ Omission of request of the previous meter record at the time of the meter replacement
- ✓ Making of the plot map of leakage repair points using Google Earth Map
- ✓ NRW calculation, NRW data analysis, the lack of the staff in charge of monitoring and analysis work, organization reinforcement are requested
- ✓ As for the POC seal, it was completed around 70% only in Ruyenzi.
- ✓ WASAC will prepare Power Distribution Board for supply of electricity and internet access at WASAC main server room and the power outlet of 220V single phase at all water treatment plants by the end of March 2019. (Technical Note on September 21, 2018)

2 Project challenges

2-1 Detail

The issues regarding project implementation and operation and the findings of technical matter are as follows.

1. The preparation of the 5YSP took long than expected, almost additional one-year compared to the initial plan. The 5YSP was approved by WASAC Board of Directors on April 27, 2018, and it was decided that its implementation will start from fiscal year 2018/2019. Meanwhile, dissemination to 20 branches is in process, and it has been recommended to branches its consideration in the preparation and implementation of the annual plan and budget.

   The implementation of some activities planned in the 5YSP is already started and will require close monitoring and updating the contents in order to reflect lessons learned from the activities performed in the Pilot areas and NRW monitoring system, etc.. However, remaining time of the present project period is not enough to consider its result for the update of the 5YSP. In addition, the successful implementation of the 5YSP will requires some institutional reorganization and more support (logistic means,equipements etc…)

2. About a construction of the Monitoring System, we observed some delays caused by unsuccessful tender in Rwanda, insufficient JICA budget. However, the completion of the installation of the

monitoring system is estimated in June 2019, there will not be time for practicing measurements and reflection time of the lessons learned from result of measuring water balance to 5YSP.

3. It is important that awareness of the NRW activities should be recognized throughout the whole WASAC organization. Depending on the department, there is a tendency towards low awareness and participation in the Project due to being busy with day-to-day work. WASAC top management need to emphasis on the importance of involvement of each WASAC staff in NRW reduction activities.

4. One of the lessons learned from Pilot Project 1 was that although not initially envisaged as being a major factor, invisible water leakage was a major source of loss. The importance of measurement of flow rate in DMAs was recognized. Because of this, identifying the areas with large water leakage by means of the step test was necessary, but it was sometimes affected by the not accurate service pipe distribution drawings, and the absence of valves on branch distribution pipelines point.

5. Leak detection still challenging mainly because of ground (not always paved road) and network condition (sometimes no valve for a long distance). In addition the number of staff trained for leak detection still low and sometimes difficulties from Japanese expert to transfer knowledge about detection

6. A feature of the topography of Kigali is its severely undulating topography. Residences have been formed on the slopes and bottoms of hills, so the water supply and distribution facilities are extremely complex. The facilities have been developed only for the purpose of transmission and distribution of water, and countermeasures against water pressure have not been taken into consideration. Therefore, there are high water pressures in the distribution pipes, and as a result, water leakages can easily occur. Even when the leak location is repaired, new leaks frequently occur because of this reason, sometimes together with the sub-standard of pipe, so it is recognized that countermeasures against high water pressure are indispensable. Control of pressure reduction is extremely important as a preventative measure.

7. In almost all cases, leakages are reported on service pipe. From the installation location conditions, pipes that are easy to lay such as polyethylene are widely used. However, procurement of the pipe that is used is done by the customer, the material quality is frequently poor (from various aspects such as price, and local availability), and material is not selected by taking into account pressure resistance.

   Quality of the installation works such as pipe connection and backfill of the pipe are also frequently not well done. Therefore, in many cases, the pipe cannot resist high-pressure and consequently causing water leaks. The importance of preventative measures such as compliance with standardized equipment, uniform materials, appropriate construction, etc.. should be recognized. Therefore, as the permanent solution it is necessary to consider pipe procurement and installation methods under WASAC responsibility, while prohibiting the procurement of the materials by customers. (Radical Treatment/Preventive measure)

The issues regarding project implementation and operation are as summarized in the table below.

Table 2.1 Issues regarding project implementation and operation

Item	Subject	Issue	Countermeasure
1.　Activity on each Output			
Output 1 1-4	Inventory survey of facilities condition	After different trials we realized that the s Facility schematic drawing of reservoirs were prepared by GIS Team in October 2017. However, the results were not sufficient.	Inventory of the facility and equipment will be summarized in the 5YSP or Master Plan. Prepare the format
1-6	Organizational change	Some activities for NRW reduction such as customer data analysis, management of data collected by monitoring system, NRW rate calculation, meter management, leak survey and high pressure control, examination of WASAC policy on service pipe management etc.are not yet sufficiently performed under the current organizational structure. There is need to review the organizational structure to ensure successful implementation of the 5YSP. WASAC Revised Structure has been approved on Oct. 02, 2017, but it is not carried out substantially...	The change of organizational structure is under review by senior management. WASAC top management need to emphasis on the importance of involvement of each WASAC staff in NRW reduction activities. Identify the gap in the NRW organization between idea and present situation. Draft of NRW unit structure will be proposed.
1-8	Specific action	The explanation of the 5YSP to 20 branches has been completed, but it is necessary that each branch customize its implementation, and establish a budget plan.	The 5YSP should be reflected in the Branch annual action plan and budget. Continue to the 4th year.
1-8	Budget	Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX) However, the available budget doesn't allow to implement full activity	Look for other financing mechanism/partners
1-11	Implementation	- Implementation of 5YSAP is started from July of the year 2018/2019. - Activity monitoring is conducted by monthly report submitted from Branches. No problem	Extension of project period is required. Continue to the 4th year.
1-12	Connection Standard and policy	WASAC should change the present policy and develop the new standard. Set up the study team or committee Organize the team for development as same as Activity 3-18 and 3-19 This is in process to approve WASAC to develop	Continue to the 4th year. We should still claim
1-13	Update 5YSP	Updating the contents will be by reflecting of the lessons learned from the Pilot Project.	Continue to the 4th year.
Output 2			
2.2 to 2.7	Trainings	Capacity Assessment of the new knowledge acquired through training has	This should be conducted by May, 2019 before JICA monitoring

		not yet been conducted	mission.
2.8	Training Manual review update		same as Activity 3-18 and 3-19
2.9	Training Programme, Training courses	Training should be intended for all branch personnel Who will be the trainers?	These should be incorporated in a training plan of Supporting Service Department (SSD).
Output 3			
3.* Basic information/data in pilot area	Uptake to an NRW rate calculation of new customer data	New customer data are not arranged and are not updated for NRW rate calculation DMA code giving are not reflected.	List should summarized in excel sheet (XY coordinate, village name, DMA code) at each branch. Boundary line of DMA should be indicated in the tablet to know the location of the new customer
	POC seal	As for the POC seal, it was completed around 70% only in Ruyenzi POC seal is so important for field work of WASAC	
	Improvement of CMS system	Omission of the previous meter reading record (billing quantity of the replaced meter) at the time of the meter replacement. Automation of the new customer addition to a list of customer data list	ICT team should modify programming of CMS.
	Customer data preparation for data analysis	A monthly billing data is not arranged in one Excel sheet every POC. Who will be in charge of this work?	
3.**	NRW rate calculation, NRW data analysis	Monthly calculation and analysis of the result is not yet performed by the Action Team. Who will be in charge of this? Lack of the staff in charge of monitoring and analysis, organization reinforcement are required.	The work should be transferred from JICA Expert to WASAC staff
3.**	Analysis of leakage repair data	Leakage history data arrangement is not sufficient. Making of the plot map of leakage repair points using Google Earth Map Data analysis of the record is not enough.	
3.13	NRW ratio of Pilot Area	There is still big difference against the targeted rate in Pilot Area 2. It is necessary to analyze a basic factor. Remaining time is not enough to achieve 25% of aims by May. What is the lessons learned from Ruyenzi?	Leakage survey is in process. Number of PRV may be insufficient. WASAC will continue the activities until achieve the aim in the 4th year.
3.12	PRV installation in Kadobogo		PM1 in Kadobogo
3.14	Cost-benefit analysis		
3.18	Development of Manual	Preparation until May, 2019 Feedback of Pilot project result Finalization in June, 2019 Approval in July, 2019	
3.19	Dissemination of the effect of pilot project result		Continue to the 4th year.
Output 4			

4.3	Construction of the Monitoring System	The schedule completion of the procurement and installation of the monitoring system is delaying.	The procurement and installation work by JICA should speed up. Continue to the 4th year.
4.3	Construction of the Monitoring System (WASAC responsibility)	WASAC will prepare Power Distribution Board for supply of electricity and internet access at WASAC main server room and the power outlet of 220V single phase at all water treatment plants by the end of March 2019. (Technical Note on September 21, 2018)	
4.2	Re-registration of the customer transferred due to the change of new proposed branches boundaries	Movement by the change of boundary line made by the hydraulic isolation.	Commercial department and GIS team will conduct before completion of the monitoring system.
4.4	Chamber construction	23 chambers have been constructed. Handover document is in process. Connection of distribution pipes have not yet completed.	M3, M19, M22,M3, WASAC will connect with distribution pipe before installation of system equipment.
4.5	Training of System input measurement	Who is the trainee? Unit/person in charge of the monitoring system management (hard & soft) is not yet clarified. Who is the trainer?	Conducted in the 4th year after system construction Responsible unit should be clarified.
4.6	Training of data management, NRW rate calculation	Unit/person in charge of the monitoring system management (hard & soft) is not yet clarified.	Conducted in the 4th year. After system construction Responsible unit should be clarified.
2. General			
	Awareness of the NRW activities	It is important that awareness of the NRW activities be shared throughout the whole organization of WASAC. Depending on the department, there is a tendency towards low awareness of participation in the Project due to being busy with day-to-day work.	The actions of the management team and the project monitoring need to be more active. Joint Monitoring should be conducted at least every three months by the management team.
	Equipment handover	Handover procedure is in process - Vehicle Mini-bus (June 2019) - Vehicle Pickup (June 2020) - Photocopy machine (June 2020) - Monitoring System (December 2019)	Acceleration of the handover procedure in WASAC

3 Modification of the Project Implementation Plan

3-1 Project Design Matrix (PDM)

None

3-2 Plan of Operation (PO)

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 5

Implementing Agency: WASAC

Dated February 28, 2019

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2019/6/30

Project Site: 6 Branches in Kigali city(Kacyiru, Nyamirambo, Gikondo, Nyarugenge, Remera and Kanombe)

Model Site:

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city（year 2022/23 : 25 %)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25% in the second SC of October 12, 2017 (39.5% on the average of Q2 , 2018)	
Project Purpose					
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure	The non-revenue water section at WASAC is not subject to large scale reorganization.	5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.	
	2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC	2 Annual action plan of WASAC	WASAC staff do not resign after training by the Project.	The workshop at every branch to explain the contents of 5YSP and how to implement was carried out by Project Manager from April to July 2018. But, 5YSP is not yet totally reflected in annual action plan of each branch. Monthly report is submitted from each branch to NRW section of HQ.	
	3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	3 Budget of WASAC	Large scale natural disaster dose not occur.	The management of WASAC has not yet see the impact of NRW reduction by the result of the pilot project. However, the management has already recognized the effect of the 5YSP, and the budget still not yet enough .	
Outputs					
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project.	1-1 Records of the project		Pilot projects (Area 1: Kadobogo, Kacyiru Branch, Area2: Ruyenzi, New Nyarugenge Branch) have not yet completed.	
	1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-2 Records of the project		Seminar will be planned to take place after preparation of the completion report of the Pilot Project.	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training.	2-1 Records of the project		About482cumulative number of trainees (55Times) were received training as of the end of May, 2018.	
	2-2 WASAC human resource development plan includes training programs prepared by the project.	2-2 Records of the project		Training programs will prepared after the completion of the pilot project	
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.	3-1 Records of the project		[Area1: Kadobogo, Kacyiru Branch] ・The baseline of the NRW rate 37% of Area 1 was decided in the SC of October 12, 2017. ・Implementation of the OJT for Area 1 has been started from June, 2017, and is still carrying out. ・Four invisible leakages were found and repaired. ・Pressure reduction measure was added as the measure other than "Apparent Loss" and "Leakage detection and repair". Two PRVs were set in October, 2018. ・NRW rate of January 2019 is 11%. It achieved the aim of 25%. ・Pipe replacement also added to the project activity. Substandard pipe replacement is caring out for about 800m. [Area2: Ruyenzi, New Nyarugenge Branch] ・The baseline of the NRW rate 68% of Area 2 was decided as the average of March and April, 2018. ・Three PRVs were set in November, 2018, ahead of other measures for NRW reduction . ・NRW rate of January, 2019 is 53%, still far from target of 25%. ・Step Test for leakage survey was performed.	
	3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.	3-2 Records of the project		Workshop will be planned after evaluation of the Pilot Project 1 & 2. (scheduled in May, 2019)	
	3-3 The action team prepares a completion report of the pilot project.	3-3 Survey plans for locations outside the pilot project		Completion report will be prepared after evaluation of the Pilot Project 1 & 2. (scheduled in May, 2019)	
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		・Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided. ・Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey. ・The 23 chambers has been constructed. ・The tender procedure on procurement and installation of the equipment of monitoring system is delaying. It is expected that the advertisement of the bid is considered to be it in March, 2019.	

Activities	Inputs		Pre-Conditions
1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.	**The Japanese Side**	**The Rwanda Side**	
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser／Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.	GIS	Management team members	
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	・GIS data should continue to be updated
1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Leak detection	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11 The management team facilitates implementation and the monitoring of the 5YSP.			
1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.			
1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-1 Training materials on NRW control are prepared.	Training in the 3rd country	Training room with the capacity of about 20 persons	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.		Space for training on pipe repair and service pipe connection（40㎡）	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Equipment for training on pipe repair and service pipe connection		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Gate valve, flow meter, and customer meter for Pilot Project	3 Local cost	
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Leak detection equipment	Cost for administering the Project (utilities for experts offices, internet services)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Equipment for survey (Mobile GPS etc.)	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8 Training materials on NRW are reviewed and updated.	Pipes and related fittings for service pipe replacement in Kadobogo	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	PRV fittings in pilot area	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali		
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Vehicles and photocopy for Japanese experts		
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	4 Facility provision		
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Chambers (4) for Pilot areas		
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.	Chambers (23) for Equipment Monitoring System		
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8 The action team conducts measures for reducing surface leakage (visible leakage).			
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12 The action team conducts measures for reducing high water pressure.			
3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			
3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.			
3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.			
3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.			
3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.			
4-4 Chambers are constructed as appropriate.			
4-5 System input to each of 4 branches is measured.			
4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 5

Dated February 28, 2019

Project Title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs		Plan / Actual	2nd Year (17/18) I	II	III	IV	3rd Year (18/19) I	II	III	IV	4th Year (19/20) I	II	III	IV	Remarks	Monitoring: Issues	Monitoring: Solution
			7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6									
Expert																	
Chief Adviser/Non-Revenue Water Management	Ootani	Plan															
		Actual															
Adviser/Non-Revenue Water Management	Higuchi	Plan															
		Actual															
NRW Reduction Plan 1 (1)	Suzuki / maguchi, Toyoda	Plan															
		Actual														Mr. Suzuki retired at the end of March, 2018.	Mr. Toyoda was assigned as the second successor next to Mr. Yamaguch
NRW Reduction Plan 1 (2)	Yoda	Plan															
		Actual															
NRW Reduction Plan 2 (1)	Toyoda	Plan															
		Actual															
NRW Reduction Plan 2 (2)	Tsutsui	Plan															
		Actual															
Geographic Information System: GIS	Horishita	Plan															
		Actual															
Hydraulic Analysis	Ooe	Plan															
		Actual															
Leak Detection	Takahashi	Plan															
		Actual															
Pipe Repairing and Service Connection (1)	Momozono	Plan															
		Actual															
Pipe Repairing and Service Connection (2)	Takashima	Plan															
		Actual															
Information and Communication Technology: ICT	Brouwer	Plan															
		Actual														Because effective time of 4.3 is undetermined, dispatch time is undecided	The schedule is decided at the time of a supplier contract with JICA
Long Term Expert	Mayusumi	Plan															
		Actual															
Equipment																	
Lot 1: Equipment for training on pipe repair and service pipe connection		Plan													delivered in May 2017 in use in the Project	handover in process	waiting CEO signature
		Actual															
Lot 2: Pilot Projects (Gate valve, flow meter, and customer meter)		Plan													delivered in May 2017, in use in the Project	handover in process	CEO has signed
		Actual															
Lot 3: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.)		Plan													delivered in July 2017, in use in the Project	handover in process	CEO has signed
		Actual															
Lot 4: Equipment for survey (Mobile GPS, Potable Test meter etc.)		Plan													delivered in October 2016, in use in the Project	handover in process	CEO has signed
		Actual															
Lot 5: Pipe and related fittings for service pipe replacement in Kadobogo		Plan													delivered in December 2018, in use in the Project	handover in process	CEO has signed
		Actual															
Lot 6: PRV fittings in Pilot area		Plan													delivered in September 2018, in use in the Project	handover in process	CEO has signed
		Actual															
Lot 7: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)		Plan													pending	not yet procured	Re-bidding procedure by JICA is in process
		Actual															
Lot 8: Vehicles and photocopy for Japanese experts		Plan													delivered in January 2017, in use in the Project	not yet handed over	This will be handed over at the end of the Project
		Actual															
Training in Japan																	
15 persons will be trained in Japan (5, 5, 5)		Plan													Completed on schedule	None	-
		Actual															
In-country/Third country Training																	
2 persons will be trained in Kenya		Plan													Completed in May 2018	None	-
		Actual															

Activities / Sub-Activities		Plan / Actual	2nd Year (17/18) I	II	III	IV	3rd Year (18/19) I	II	III	IV	4th Year (19/20) I	II	III	IV	Responsible Organization: Japan	RWANDA	Achievements	Issue & Countermeasures
			7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6										
Output 1: Planning capacity of NRW reduction of WASAC is enhanced.																		
1.1	A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.	Plan													Expert	WASAC	Members of the Team were appointed in August 2016. Some change in September 2017.	None
		Actual																
1.2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	Plan													Expert	WASAC	Questionnaire survey, Site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems.	None
		Actual																
1.3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan													Expert	WASAC	Discussion in a series of Workshops. Framework of Action Plan was approved in the seminar on May 29, 2017	None
		Actual																
1.4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan													Expert	WASAC	Facility schematic drawing of reservoirs were prepared by GIS Team in October 2017.	The results were not sufficient Inventory of the facility and equipment will be summarized in the 5YSP or Master Plan.
		Actual																
1.5	Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP	Plan													Expert	WASAC	Draft Final report of 5YSP was approved at the second SC on Oct. 12, 2017	None
		Actual																
1.6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan													Expert	WASAC	The organization recognized the importance of the organizational change and the structure is under review by senior management	The budget may be the constraint for the implementation of the new proposed structure
		Actual																
1.7	The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Plan													Expert	WASAC	A yearly implementation schedule for each specific actions and its priority were prepared.	None
		Actual																
1.8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan													Expert	WASAC	Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX)	The budget has been secured trough AfDB loan, the implementation may
		Actual																
1.9	The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan													Expert	WASAC	5YSP was officially approved by the Board of Directors on April 27, 2018.	None
		Actual																
1.10	The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan													Expert	WASAC	5YSP was shared at the SC on October 12, 2017. Approved 5YSP by both management and BoD. Explained at each Branch from April to July 2018. Workshop was held on July 19, 2018	None
		Actual																
1.11	The management team facilitates implementation and the monitoring of the 5YSP.	Plan													Expert	WASAC	Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018. Monitoring was conducted for 2018/19 Q1 and Q2 by monthly report.	The monthly report lacks independence will of Branch Office. 20 branch are divided into four groups and let them report every month in Kigali.
		Actual																
1.12	The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	Plan													Expert	WASAC	Not yet	Revise present WASAC standard based on the lesson obtained from the pilot project. Organize the team for preparation as same as Activity 3-18 and 3-19.
		Actual																
1.13	The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan													Expert	WASAC	Not yet	None
		Actual																

1.14	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.			Plan / Actual		Expert	WASAC	Not yet	None
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.								Achievements	Issue & Countermeasures
2.1	Training materials on NRW control are prepared.			Plan / Actual		Expert	WASAC	Completed	None
2.2	Training on NRW management is conducted for the management team and WASAC management as necessary.			Plan / Actual		Expert	WASAC	Completed	Capacity assessment not yet completed
2.3	OJT is conducted on the updating of GIS data, using available GIS data base.			Plan / Actual		Expert	WASAC	Completed	Capacity assessment not yet completed
2.4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.			Plan / Actual		Expert	WASAC	Completed	Capacity assessment not yet completed
2.5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.			Plan / Actual		Expert	WASAC	Completed	Capacity assessment not yet completed
2.6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.			Plan / Actual		Expert	WASAC	Completed	Capacity assessment not yet completed
2.7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.			Plan / Actual		Expert	WASAC	Completed	Capacity assessment not yet completed
2.8	Training materials on NRW are reviewed and updated.			Plan / Actual		Expert	WASAC	in process	same as Activity 3.18
2.9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.			Plan / Actual		Expert	WASAC	Not yet	None
Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.								Achievements	Issue & Countermeasures
A. Preparation				7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6					
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.			Plan / Actual		Expert	WASAC	Member of the Team were appointed in August 2017	Some of the members resigned or transferred in September 1907.
3.2	The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.			Plan / Actual		Expert	WASAC	Completed	None
3.3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.			Plan / Actual		Expert	WASAC	Completed	None
3.4	The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.			Plan / Actual	Procurement of Equipment and Construction of Chamber	Expert	WASAC	Flow meters and pressure gauges were installed in the meter chambers by May 2017.	None
**	Data update for calculation of NRW rate and analysis of NRW			Plan / Actual		Expert	WASAC		Calculation data of NRW rate had a problem, because of insufficient POC list of new connection. Insufficient of customer data such as XY coordinate and village name to confirm the location of the customer. Branch office should be report correctly.
B. Activity of Pilot Area 1 Kadobogo									
3.5	The action team establishes the baseline NRW rate of Pilot Area 1.			Plan / Actual		Expert	WASAC	Baseline: Mean value of June, July 2017 Original: 36.0% Revised: 37.3%	
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			Plan / Actual		Expert	WASAC	The meters which should be changed were 327 as a result of on-site meter test (total connection 1,240). In this, 323 were replaced.	It took 4 months for on-site calibrations test. The standard for extraction of the subjects of survey was demanded for shortening at work period.
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			Plan / Actual		Expert	WASAC	Effect was evaluated on three comparisons cases of before and after replacement. 1. Total meter error , 2. Consumption volume of replaced meters, 3. NRW rate	There is difficulty to measure the effects separately in time as in 3.7 and 3.9. And also, the consumption changes by a user occasional demand. Case 1 is the most reasonable way.
3.8	The action team conducts measures for reducing surface leakage (visible leakage).			Plan / Actual		Expert	WASAC	In process as daily routine work of Branch office	When water leaks are discovered it is necessary to carry out repairs immediately, so meter replacement and repair of leaks were carried out in parallel.
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			Plan / Actual		Expert	WASAC	The leak volume does not decrease even if repairs were repeated (an average of ten places a month)	High water pressure management and invisible leakage survey had not been conducted so far.
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).			Plan / Actual		Expert	WASAC	Invisible water leakages detections were successfully implemented in June in PM2 ,March and April in PM3.	It is still challenging for leak survey and detection due to the lack of number of people trained, for dissemination of this technology. Strengthening of the organization structure is strongly requested.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.			Plan / Actual		Expert	WASAC	After repaired of invisible leakages, NRW rate decreased much. A steady leakage survey is very important. Step test of Qmnf is quite effective to make a plan and strategy for the leak detection.	Lack of existing valves at branching point. This fact causes problem of excessive digging work necessary for flowmeter setting. It is hard to know the undergrounding position of the pipes.
3.12	The action team conducts activities for reducing high water pressure.			Plan / Actual		Expert	WASAC	PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block. After setting pressure, NRW decrees much.	Preliminary study to decide the location for installation should be conducted carefully.
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.							The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV will be compared.	None
3.14	The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.			Plan / Actual		Expert	WASAC	Not yet	The works conducted in the pilot project and expended cost for that works will be summarized for cost-benefit analysis. Average unit billing price and unit production cost will be calculated.
	The action team summaries activities and results			Plan		Expert	WASAC		

3.15	The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Aria 1, and submits it to the management team.			Actual				Not yet	in May 2019
3.16	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.			Plan Actual	Expert	WASAC	Not yet	in May 2019	
C. Activity of Pilot Area 2 Ruyenzi									
3.2	Preparation Work (POC data compilation) (Review)			Plan Actual	Expert	WASAC	in process	POC number seal has been put on customers entrance gates (about 70% ? only)	
3.4	Preparation Work (Hydraulic Isolation of Pilot Area) (Review)			Plan Actual	Expert	WASAC	Completed	None	
3.5	The action team establishes the baseline NRW rate of Pilot Area 2.			Plan Actual	Expert	WASAC	Baseline: Mean value of March, April 2018 Original: 68.4%	None	
3.12	The action team conducts measures for reducing high water pressure			Plan Actual	Expert	WASAC	Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept. , one in RY2 in Oct., 2018.	Preliminary study to decide the location for installation should be conducted carefully.	
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			Plan Actual	Expert	WASAC	The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. NRW rate before and after PRV adjustment was compared in A2 (Small DMA). Also, Qmnf before and after setting PRV will be compared.	None	
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 2.			Plan Actual	Expert	WASAC	General meter physical inspection for all customers 1,703 was conducted. The meters which should be changed were 139 as a result of on-site meter test (big consumer 413). In this, 135 were replaced.	Delay	
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			Plan Actual	Expert	WASAC	The result of meter test shows that the effect of meter replacement was minus but quite negligible.	None	
	The step test in Qmnf was conducted as the preliminary survey for leakage detection			Plan Actual	Expert	WASAC	Step test was conducted in February, 2019. The result shows that most critical area of leakage is high pressure area by bypass.	None	
3.8	The action team conducts activities for reducing surface leakage (visible leakage).			Plan Actual	Expert	WASAC	In process	None	
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			Plan Actual	Expert	WASAC	Not yet	None	
3.10	The action team conducts activity for reducing underground leakage (invisible leakage).			Plan Actual	Expert	WASAC	Not yet	None	
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.			Plan Actual	Expert	WASAC	Not yet	None	
3.14	The team reviews the results of Activities, and undertakes cost-benefit analysis of NRW for each Activity.			Plan Actual	Expert	WASAC	Not yet	in April 2019	
3.15	The team summaries activities and results from Activities, prepares the completion report on the pilot project, and submits it to the management team.			Plan Actual	Expert	WASAC	Not yet	in May 2019	
3.16	The team holds a workshop and presents the completion report of the pilot project prepared by Activities to WASAC and other concerned parties.			Plan Actual	Expert	WASAC	Not yet	in May 2019	
D. Manual and Seminar				Plan					
3.18	Action team prepares manuals on methods and use of survey equipment learned from the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			Plan Actual	Expert	WASAC	Not yet	Delay	
3.19	Action team disseminates the manual and use of survey equipment to the activity of whole branches.			Plan Actual	Expert	WASAC	Meeting for manual development was held on January 29, 2019.	preparation by May 2019	
Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.							Achievements	Issue & Countermeasures	
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			Plan Actual	Expert	WASAC	Completed	None	
4.2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			Plan Actual	Expert	WASAC	Completed	None	
4.2	Re-registration of the customer transferred due to the change of new proposed branches boundaries			Plan Actual	Expert	WASAC	Movement by the change of boundary line made by the hydraulic isolation has not yet conducted.	Commercial department and GIS team will conduct before completion of the monitoring system.	
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.			Plan Actual	Expert	WASAC	JICA HQ decided to carry out a re-tender after the process failed in JICA-Rwanda . JICA HQ is now in process of bid preparation. The real progress has delayed compared to the initial plan.		
4.4	Chambers are constructed as appropriate.			Actual	Expert	WASAC	23 meter chambers have been constructed	None	
4.5	System input to each of 4 branches is measured.			Plan Actual	Expert	WASAC	Schedule is delay.	The project period was extended for one year.	
4.6	Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			Plan Actual	Expert	WASAC	Schedule is delay.	The project period was extended for one year.	

Duration / Phasing	Plan															
	Actual															

Monitoring Plan	Plan	2nd Year (17/18)				3rd Year (18/19)				3rd Year (18/19)				Remarks	Issue	Solution
	Actual	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ			
Monitoring		7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6			
Steering Committee	Plan													SC was held on August 28, 2018. Next will be scheduled in May 2019 at the time of Project Monitoring Mission		
	Actual	Apr.	Oct. 12													
Set-up the Detailed Plan of Operation	Plan															
	Actual															
Submission of Monitoring Sheet	Plan													Monitoring Sheet ver.6 should be submitted before Monitoring Mission		
	Actual															
Monitoring Mission from Japan	Plan													In May 2019 by JICA HQ		
	Actual															
Joint Monitoring	Plan															
	Actual															
Post Monitoring	Plan															
	Actual															
Reports/Documents																
Inception Report	Plan															
	Actual															
Progress Report	Plan															
	Actual															
Project Completion Report	Plan															
	Actual															
Public Relations																
Seminars and Workshops	Plan															
	Actual															

TO CR of JICA　RWANDA　OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet ：Ver.6（Term: July, 2017 – July, 2020: 2nd Phase）

Name: Shigeo OTANI

Title: Chief Advisor/ Non-Revenue Management

Submission Date: May 20, 2019

I. Summary

1 Progress

1-1 Progress of Inputs

1-1-1 Japan Side

(1) List and Assignment Terms of Japanese Experts

a. Working in Rwanda

Table 1.1 Assignment Term in Rwanda (Phase 2) Working in Japan

	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2017/8/5	2017/10/16	2.43
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/9/18	1.50
			2018/10/20	2018/11/29	1.37
			2019/1/15	2019/3/9	1.80
			2019/4/15	2019/5/20	1.17
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2017/8/5	2017/9/17	1.47
			2018/5/24	2018/7/12	1.27
3	NRW Reduction Plan 1（1）	Chiaki SUZUKI/ Hiroyuki YAMAGUCHI Toru TOYODA	2017/8/5	2017/9/23	1.67
			2018/1/16	2018/3/1	1.50
			2018/5/9	2018/7/7	1.77
			2018/10/12	2018/12/27	2.57
4	NRW Reduction Plan 1（2）	Hiroyasu YODA	2017/11/8	2017/12/22	1.50
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/10/3	2.00
			2019/2/18	2019/4/6	1.60
5	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2017/8/5	2017/9/3	1.00
6	Leak Detection	Junichi TAKAHASHI	2017/12/3	2018/2/15	2.50
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2018/2/5	2018/4/5	2.00
8	ICT	Marcel Brouwer			
Total MM					33.12

Note: Man Month (MM)

b. Working in Japan

Table 1.2 Assignment Term in Japan

No.	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2018/6/4	2018/6/8	0.25
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2017/8/1	2017/8/10	0.40
			2017/10/30	2017/11/9	0.40
Total M/M					1.05

Details of each expert's assignment are shown in the Plan of Operation (see Project Monitoring Sheet-II "Plan of Operation").

(2) List of Equipment Provided for the Project

Table 1.3 (1) List of Equipment

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Output 2	Materials and equipment for training for pipe repairing and service connection	set	1	Consultant	May. 2017 Completed	in process
Lot 2	Output 3	Customer meter DN15mm	sets	400	Consultant	Feb. 2017 Completed	in process
Lot 3	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Consultant	May. 2017 Completed	in process
Lot 6	Output 3:	Pipes and rerated fittings for service pipe replacement in Kadobogo	set	1	Consultant	Dec. 2018 Completed	in process
Lot 7	Output 3:	PRV fittings in pilot area	set	1	Consultant	Dec. 2017 Completed	in process
Lot 4	**Output 4: Isolation of 4 Branch**	**Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.**	**set**	**1**	**JICA office**	**March 2020 Scheduled**	**not yet**
Lot 5	**Vehicles for JICA use**	**Minibus May 31, 2019 Pickup June 30, 2020**	**Units**	**2**	**JICA office**	**Jan. 2017 Completed**	**not yet**
Lot5	**Photocopy Machine**	**June 30, 2020**	**Unit**	**1**	**JICA office**	**August 2016**	**not yet**

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity		Schedule	Handover to WASAC
Lot 8	Output 2: Leak detection equipment（for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	sets	3	JICA HQ	Jul. 2017 Completed	not yet
Lot 9	Survey Equipment for Output 2and 3	Potable GPS, Potable Test Meter, Residual Chlorine Test Meter, Potable Electric conductivity Meter	set	1	Consultant	Oct. 2016 Completed	not yet

Note: Those items are used for the training activity during the Project period.
The above mentioned equipment except Lot 5 should be handed over to WASAC immediately after delivery and WASAC will maintain them. The equipment of Lot 5 will be managed by the JICA Expert

Team during the Project period and shall be handed over to WASAC at the end of the Project period

(3) List of Facilities Provided for the Project

Table 1.3 (2) List of Equipment

Facilities to be Provided

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Chambers for Pilot Areas	2 chambers for Pilot Area1 1 chamber for Pilot Area 2	set	1	Consultant	May. 2017 Completed	Completed
Lot 2	Chambers for Monitoring System	Customer meter DN15mm	set	1	Consultant	Sept. 2018 Completed	Completed
Lot 3	Monitoring System		set	1	Consultant	In progress	Not yet
Lot 4	Chambers for Pilot Area	Kadobogo 1 (PM3)	set	1	Consultant	September 2018	Not yet

1-1-2 Rwanda Side

(1) Counterpart

See Project Progress Report. (Part3)

Table 1.5　Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Celestin MWAMBUTSA	Head of water distribution services, WOS, UWSS
Output 3	Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

(2) Facilities

- Office space for Japanese experts at WASAC Head Office, office furniture
- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

(3) Local Cost

- Cost for administering the Project (utilities for expert offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project for 2nd Phase

Start-up Meeting of the Project was held Aug. 9, 2017 with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Submission of Progress report (Part 1), Monitoring Sheet (Ver. 3), Work Plan (Ver. 3)
- Brief explanation of Project implementation for Phase 2
- Schedule of Management Team Meeting (Joint Monitoring) and Steering Committee (SC)

(2) Management Meeting (Joint Monitoring)

In the third joint monitoring conducted at the management team meeting held on August 9, 2017, the Work Plan of Phase 2 and Monitoring Sheet (Ver.3) were submitted. The topics for discussion of the past joint monitoring are shown below.

Table 1.6　Main items checked and actions taken in the joint monitoring

No.	Implementation period	Main items checked and actions taken	Changes to R/D, PDM, PO, etc.
Version 1	September 15, 2016	None in particular	None
Version 2	March 15, 2017	・ The activities of Output 1 (Activities 1.2 to 1.10) have been extended for about 3 months → To be completed by the end of August 2017 ・ The activities of Output 4 (Activity 4.3) has been extended due to the delay in procurement of equipment → Activities to continue in Phase 2	PO Version 1 →PO Version 2
Version 3	Aug 9, 2017	・Joint Monitoring Progress of each activity (preparation of 5YSP, Technical training, Pilot project, Isolation of 4 branches, Equipment procurement, others) ・Work Plan for Phase 2 Outputs ・Contents and implementation schedule of the Pilot Project	PO Version2 →PO Version3
Version 4	August 20, 2018 (before Monitoring Mission)	Progress until August 2018 of Phase2 Achievements, issues and challenges Proposal of amendment of PO	Revision of RD, PDM, PO
Version 5	Scheduled at May 2019 (before Monitoring Mission)	Progress until May 2019 of Phase2 Achievements, issues and challenges Proposal for 4th year of the Project	
Version 6	May 20, 2019	Progress until May 2019 of Phase2 Achievements, issues and challenges	Revision of PO

(3) Steering Committee (SC)

The results of holding SC meetings and future plans and agenda are as shown in the table below.

Table.1.9 The held time of the SC meeting and the agenda

Time	Holding time	Theme, contents
1st	April 3, 2017	・Discussion of the work plan (WP1), approval ・Confirmation of the Rwandan side burden matter
2nd	October 12, 2017	・Progress confirmation of the project ・Common knowledge of the NRW reduction 5YSP ・Approval of the second work plan ・About the enforcement of the project evaluation
3rd	August 28, 2018August 28, 2018 At the time of Project Monitoring by JICA	・Result of Joint Monitoring ・ Procurement and Installation Plan of the Equipment for Monitoring System ・Monitoring result of the JICA Monitoring Survey Mission
4th	May 22, 2019	・ Progress of the Project ・ Rescheduling of Equipment Procurement and Installation of Output 4 ・ Additional Activities ・ Revised Work Plan for Phase 2

(4) Weekly Meeting

As a rule, PIM meetings are held at the end of every week and the activities for the week are reported, the activities scheduled for the following week are confirmed and pending issues, matters of concern, requests, etc., are discussed. The meetings are also utilized as a venue for training through seminars and workshops on matters proposed by the experts, etc. Meetings have been held seventy-three times as of the end of April 2019 (including thirty times in Phase 1).

(5) Project Progress Report (Part 1)

Project Progress Report (Part 2) was submitted to JICA and WASAC at the end of June 2018 and in August, respectively.

1-2-2: Training in Japan and in the 3rd Country

(1) Training in Japan

Table 1.10 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5	- Introduction to water service management and NRW - Outline of water facilities in Yokohama and Kobe Cities and other matters
2	August 14 to 30, 2017	Business affairs and GIS matter	5	- Introduction to water service management and NRW - Customer information management, meter management and reading, and water service management - Examples of how local governments utilize GIS, purposes of use, and other matters
3	Nov. 13 to 30, 2017	Technical matter	5	Introduction to NRW, pressure management, leak detection, distribution management, and other matters

(2)　Training in the 3rd country

Training in the 3rd country was conducted in Kenya as shown in the table below.

Table 1.11 Training in the 3rd country

No	Timing	Field of training	Trainees	Training Themes
1	May 7 to 10, 2018	Management Team	2	An introduction and discussion of activity on NRW reduction carried out in each other's countries.

1-2-3: Activities of Output

【Activities of Output 1】:

Planning capacity of NRW reduction of WASAC is enhanced.

1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.

Members of the Team were appointed in August 2016. Some change in September 2017.

See Project Progress Report (Part 2).

1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

Questionnaire survey, site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems. These have done.

See Project Progress Report (Part 2).

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

Discussion in a series of Workshops have been conducted. Framework of Action Plan was approved in the seminar on May 29, 2017. See Project Progress Report (Part 2).

1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

The inventory survey was carried out by the WASAC GIS team and preparation of the schematic layout drawing of the distributing reservoir facilities was completed in October 2017. However, as a result of on-site verification of the results, many deficiencies were recognized, so it is desirable to implement measures for this in the 5YSP activities.

A survey of the functions of the distributing reservoirs and pressure regulator tanks was proposed as an additional activity in the fourth year at the fourth SC meeting and the meeting resolved to implement the survey in July or later in 2019.

1-5　Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP.

The final draft report of 5YSP was completed at the end of September 2017 and the report was discussed in the workshop attended by the branch managers and key staff of the six branches in Kigali on October 4. Then, at the second SC meeting held on October 12, 2017 in which MININFRA and the WASAC Management Team and Action Team participated, common knowledge and consensus building with regard to 5YSP (Final Draft) were promoted among all related departments. Afterwards, further discussions were carried out mainly by the NRW unit aimed at practical implementation, and a monitoring plan was added.

・Workshop　：October 4, 2017
・Steering Committee　：October 12, 2017

1-6　The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

Although WASAC planned to reform its organizational structure with MININFRA's approval, the reform plan has not been implemented. WASAC is currently reviewing its organizational structure again. No reorganization was carried out at the current stage. For the time being, the goal is clarification of the responsibilities of the departments in charge in the existing organization and reinforcement of interdepartmental cooperation. However, in order to specifically implement the activities of the 5YSP, enhancing the activity organization for data analysis, water leak detection, water leak repairs, etc., which is insufficient at present is an issue.

1-7　The management team prioritizes and schedules the conducts of specific actions of 5YSP

A yearly implementation schedule for each specific action was prepared. As a future issue, it is necessary for each head office section and branch office to draw up individual detailed action plans, including construction of the facilities and procurement of the equipment (surveying equipment, vehicles, etc.). This will require time, so it will be worked out in detail with the passing of time. The specific actions, which can be performed in 5YSP, will be implemented sequentially in the annual action plans of each branch for the time being.

From April to July 2018 all 20 branches were visited, and after explaining the content of the 5YSP and explaining the monthly report form for monitoring, it was decided that for the time being those activities of the 5YSAP that can be carried out will be gradually incorporated into the annual activity plan for each branch.

1-8　WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal

year.

The content of the implementation items is not particularly affected for the time being, because most of the activities for NRW reduction fall under the regular budget (Utility Budget: liquidity costs and OPEX: maintenance expenses).

1-9 The management team prepares the 5YSP that summarizes the achievements from Activities 1-1 to 1-7.

A management meeting attended by all DUWSS managers and all section heads was held on November 14, 2017, and the latest edition of the report was explained. The result was reported to the CEO and the Branch Managers the next day.

A report was submitted to the Senior Management Team by the project director Mr. Methode on December 15, and the report was approved in the Senior Management Meeting held on February 12, 2018. 5YSP was finally officially approved by the WASAC Board of Directors on April 27, 2018. After responding to the comments received, the final approval of the WASAC Board of Directors was obtained on April 27. Implementation of the plan has been delayed by 1-year relative to the schedule, and will be commenced in fiscal year 2018/2019.

1-10 The management team holds seminars and presents 5YSP (Activity 1-8) for WASAC and other concerned parties.

5YSP was shared with the relevant persons in MININFRA and WASAC at the SC meeting on October 12, 2017.

The Project Manager and JICA expert had visited all WASAC branches between April and July 2018 and explained 5YSP to the staff members of the branches to make all of them understand it. The recording format for the monthly 5YSP activity report required for the explanation was finalized.

An in-house workshop was held in WASAC on July 19, 2018, to identify activities required for achieving the goal of the first year of the Non-Revenue Water Reduction 5YSP from the progress of and the problems found in the implementation of the plan.

1-11 The management team facilitates implementation and the monitoring of the 5YSP.

WASAC is monitoring and evaluating the implementation and output of 5YSP, respectively. 5YSP is to be reviewed based on the outcome of the ongoing pilot projects. The CEO of WASAC officially appointed the five members of the 5YSP Implementation Monitoring Team on September 3, 2018.

Quarterly reports submitted by the branches are to be used for monitoring the implementation of 5YSP. The activity reports for the first quarter between July and September 2018 (Q1, July - September) were submitted in November. A workshop on the conclusions of the reports was held in the Galaxy Hotel on

December 7, 2018, and a briefing session to explain the conclusions to the CEO was held on January 7, 2019.

The contents of the reports for the second quarter (Q2, October - December) were analyzed and workshops on the analysis results in the commercial and water distribution areas were held separately. The 20 branches were divided into five groups and the workshops were held by group. The workshops in the commercial area were held between March 4th and 8th for the five groups and the Project Manager and JICA long-term expert participated in the workshops to report and discuss the analysis results. The report for the third quarter (Q3, January - March) was analyzed in April 2019.

1-12　The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.

Initially, this activity was planned to be done by the Project. However due to the emergency to comply with RURA, this documents was done by Commercial Directorate of WASAC (Connection Policy, Jan, 2019).

1-13　The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

The report on the 5YSP has been updated at any time based on the progress and output of the pilot projects, Output 3 pilot activities, under the guidance of the JICA long-term expert.

1-14　Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

The finalized 5YSP report will be announced. It is scheduled for last month of 2019.

【Activities of Output 2】:

Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2-1 Training materials on NRW control are prepared.

Done. See Project Progress Report (Part 2).

2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.

Done. See Project Progress Report (Part 2).

2.3　OJT is conducted on the updating of GIS data, using available GIS data base.

Done. See Project Progress Report (Part 2).

2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

Done. See Project Progress Report (Part 2).

2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

Done. See Project Progress Report (Part 2).

2.6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

Done. See Project Progress Report (Part 2).

2.7 In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

Done. See Project Progress Report (Part 2).

2-8 Training materials on NRW are reviewed and updated.

As part of the activity 3.18 for Output 3, a team was established for the preparation of a manual of the pilot project and the team began the preparation in the end of January 2019. The team is expected to compile the manual based on the various training materials used in the Output 2 activities and adding the methods of activities practiced in the Output 3 pilot project to those materials. The revision of the training materials is part of the manual preparation.

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

The Support Service Department (SSD) is responsible for the planning of training in WASAC. The training programs to be prepared in this project should be incorporated in the scheme of the training plan of entire WASAC. The training on activities based on the above-mentioned manual shall be incorporated in the training program of WASAC to disseminate the NRW control technology to all staff members of WASAC. The cooperation between the departments responsible for NRW control and SSD shall be strengthened for the dissemination of the technology. A practical discussion on the manual shall be commenced when its specific contents are beginning to take shape.

【Activities of Output 3】

: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

A. Project Preparation

3-1 The action teams are organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.

Member of the Team were appointed in August 2017. See Project Progress Report (Part 2).

3-2 The action team grasps the current situations of Pilot Area 1 and Pilot Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.

Done. See Project Progress Report (Part 2).

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Pilot Area 2.

The implementation plan and implementation schedule have been formulated for Pilot Areas 1 and 2. This is as shown in the Work Plan produced in Phase 1 and the beginning of Phase 2.

The heavy rainfall in May 2018 caused flooding of the Nyabugogo River, which damaged the water supply pipeline from Nzove Purification Plant. WASAC began the repair of the pipeline and completed it on June 23, 2018. Because the water supply from the alternative water source during the repair period was not stable, water rationing was frequently put in place. This water rationing delayed the progress of the project activities and the schedule for the implementation of the pilot activities was revised in the end of June.

The implementation schedule was also revised in accordance with the outcome of the third and fourth SC meetings (on August 28, 2018 and May 22, 2019, respectively).

3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1and 2.

The positional coordinate data of customer POCs were collected with mobile GPS receiver in the on-site customer POC number survey. POC positional maps were created by superimposing the collected coordinate data on Google Maps-based GIS distribution pipe maps. The hydraulic isolation in each area and each subzone of the area were confirmed on the POC positional maps to finalize the boundaries of the areas and subzones. The POC lists and POC positional maps were revised during this confirmation work.

See Project Progress Report (Part 2).

3-5　The action team establishes the baseline NRW rate of Pilot Area 1 and Area2

Done. See Project Progress Report (Part 2).

Area1: Baseline: Mean value of June, July 2017. NRW Rate is: 37.3%

Area2: Baseline: Mean value of March, April 2018. Original: 68.4%

B.　Activity of the Pilot Area

3-6　The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1 and Area 2.

Area1:　The existing 327 customer meters were replaced with the new one by the result of on-site meter test (total surveyed 1,172).

Area2: General meter visual inspection for all customers 1,703 was conducted. In this, 135 were replaced by the result of on-site meter test.

3-7　The action team measures NRW after conducting Activity 3-6 and examines its effectiveness

Area1: Effect was evaluated on three comparisons cases of before and after replacement.　1. Total meter error , 2. Consumption volume of replaced meters.

Area 2:　The result of meter test shows that the effect of meter replacement was minus but quite negligible.

3-8, 3-10 The action team conducts measures for reducing surface leakage (visible leakage) and underground leakage (invisible leakage).

Surface leakage is discovered daily during various site surveys (including the meter accuracy surveys, questionnaire surveys and hydraulic isolation) and WASAC's on-site operations. The repair of surface leaks is part of the regular maintenance of each branch and water leaks in the pilot areas are repaired by the branch responsible for the areas immediately after leaks have been discovered.

The survey of underground leakage commenced in January 2018. The measurement of minimum night flow (Qmnf) was carried out to quantify water leakage and the leakage step test was carried out to identify areas with large water leakage.

The purposes of the Qmnf measurement are:

① To quantify water leakage to identify leakage points (implement leakage step test),

② To compare the quantities of water leakage before and after the implementation of leakage reduction activities to measure their effectiveness, and

③ To monitor the quantity of water leakage regularly.

3.9, 3.11, 3.13　Measure NRW after conducting Activity 3.8, 3.10, 3.12 and examine its effectiveness

In the analysis of the project effect, the effect of all the activities in the pilot projects and that of individual activities on the NRW reduction were evaluated. The effect was evaluated with the following four indicators.

① Change in NRW rate
② Change in the number of the repair
③ Change in Qmnf
④ Cost-benefit analysis.

3-12　The Action team conducts measures for reducing high water pressure.

The activities for the pressure control were discussed in the SC meeting in August 2018 and incorporated in the activities of the amended R/D.

1) Pilot Area 1

As the water pressure in the distribution pipe at the inflow point in Pilot Area 1 was high (over 10 bars), pressure reducing valves (PRVs) were installed in PM2 and PM3 to control the water pressure by reducing the pressure in the distribution area. PRVs and pipes that WASAC had in stock were used to install the PRVs. The Japanese side undertook the procurement of the pipes required for the PRV installation that WASAC did not have in stock and the construction of manholes.

A survey was conducted on the operating status of the PRV re-installed in PM2 on May 31, 2018. The pressure measurement for two days proved that the secondary pressure (P2) had been regulated at 4 bars (reduction of approx. 6 bars). Since the completion of the installation of a PRV in PM3 on Sept 18, 2018, the high pressure on the primary side (P1) of the PRV has been reduced to 2.5 bars on the secondary side (P2), which has been used for distributing water in PM3.

2) Pilot Area 2

PRVs had been installed at two locations in the lower reaches in RY1 and a location in the lower reaches in RY2 by November 2018. The pressure on the secondary side of PRVs has been adjusted.

3-14　The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.

Area 1 : The cost-benefit analysis was done by using dada as of May 2019.

Area 2 : Not yet

3-15　The action team summaries activities and results from Activities 3-1 to 3-14, prepares the

completion report on the pilot project, and submits it to the management team.

Not yet.

3-16　The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.

Not yet.

3-18　Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

It was decided to set up the manuals preparation team of the pilot project inside WASAC and prepare the manuals in coordination with this team. The manuals preparation meeting (kickoff) is held on January 29th, and meetings are held regularly.

- ✓ Purpose: To show all staff the appropriate methods implemented in the pilot project applied to each of the NRW reduction activities.
- ✓ Goal of use: Achievement target of 5-year strategic plan
- ✓ User: All WASAC staff
- ✓ Period of use: At the start of each activity
- ✓ How to make: Organize each individual work manual
- ✓ Deadline for preparation: May 2019

3-19. Action team disseminates the manual and use of survey equipment to the activity of whole branches.

Not yet.

【Activities of Output 4】：

4 branches in Kigali establish the system to measure NRW rates accurately.

4-1　Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

Done. See Project Progress Report (Part 2).

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

Done. See Project Progress Report (Part 2).

4-3. Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4

branches.

The progress of the procurement is more than one year behind the overall procurement schedule described in the Plan of Operation in RD. JICA Headquarters explained the reasons for the slow progress and a new procurement schedule to the Director General of DUWSS on April 17, 2018.

4-4. Chambers are constructed as appropriate.

Construction of the chambers was scheduled to be completed in Phase 1 by outsourcing to a local company, but the construction work was delayed due to a delay in equipment procurement by the contractor, the effect of flooding of the construction sites during the rainy season, and not determining construction locations. The construction continued to be implemented in Phase 2 at 12 locations.

Table 3.1 Chamber construction progress status (as of end of May 2019)

No.	Progress	Phase
M1, M2, M4, M5, M6, M12, M13, M15, M17, M19, and M23	Completed on May 25, 2017	Phase 1
M7, M8, M9, M10, M11, M14, M16, M18, M20, and M21	Completed on August 3, 2017	Phase 2
M22	Completed on October 13, 2017	Phase 2
M3	Completed on September 10, 2018	Phase 2

The construction M22 and M3 was completed on September 10, 2018 and they were inspected for defects on February 20, 2019. After the CEO of WASAC signed a letter of acceptance addressed to JICA on February 28, the equipment was handed over to WASAC. M19 and M22 had not been connected to water distribution pipelines as of May 31 for reasons attributable to WASAC.

4-5. System input to each of 4 branches is measured.

A calculation sheet will be prepared for the calculation of the balance between supply and consumption of water distributed to the service area of each branch. After the monitoring system has been established, the sheet will be used for the recording of amounts of distributed water and calculation of the amount water distributed and NRW rate in the service area of each branch. The NRW rates calculated above will used for the revision of 5YSP as an indicator for NRW reduction in Kigali.

4-6. Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.

The calculation of NRW rate in each branch will be started after construction of the monitoring system.

1-3 Achievement of Output

1)　Plannning Capacity of NRW reduction

Pilot projects (Kadobogo of Kacyiru Branch, Ruyenzi of New Nyarugenge Branch) have not yet completed.

Seminar will be planned to take place after preparation of the completion report of the Pilot Project.

2)　Basic knowledge, skills and technique on NRW control

482 cumulative number of trainees were received training.

Training programs will prepared after the completion of the pilot project

3)　WASAC learned how to conduct NRW reduction measures though the pilot project

Pilot Area 1:　12% (Q3 of 2019/20)

Pilot Area 2:　54% (Q3 of 2019/20)

Workshop will be planned after evaluation of the Pilot Project 1 & 2.

Draft of completion report of Area 1 was prepared.　The report of Area 2 will be prepared beginning of 2020.

4)　4 branches in Kigali establish the system to measure NRW rates accurately

・Boundary line for Isolation of 4 branches was decided.

・Exact locations for the installation of electromagnetic flowmeters were decided.

・The 23 chambers has been constructed.

・The tender procedure on procurement and installation of the equipment is delaying.

1-4 Achievement of the Project Purpose

5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.

NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. In the future more specific actions for NRW reduction is needed.

The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area.

1-5 Achievement of Overall Goal

Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017

(36 % on the average of Q3 , 2018/19)

1-6 Changes of Risks and Actions for Mitigation

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

1-7 Progress of Actions undertaken by JICA

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment was procured in July 2017.
- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is behind the schedule.

1-8 Progress of Actions undertaken by Rwanda side

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Preparation of 5-year Strategic Action Plan for NRW reduction.
- Joint visit JICA-WASAC of WASAC's upcountry branches.
- Training in Japan
- Training in the third Country

1-9 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

None

2. Project challenges

The issues regarding project implementation and operation and the findings of technical matter are as follows.

2.1 The joint monitoring conducted on May 20, 2019 revealed the following four issues in the project at that time.

- Slow progress in the achievement of the overall goal,
- A need for an action plan specifically designed for each branch for the achievement of the project purpose.
- A need for further efforts to achieve the target rate of Pilot Project 2, and
- Early procurement and installation of the monitoring equipment

Table 2.1. Project purposes and outputs (6th Joint Monitoring)

Narrative Summary		Verifiable Indicators		Achievement
Overall Goal				
WASAC conducts NRW reduction measures as planned for Kigali city.			NRW rate of Kigali city （year 2022/23 : 25 %)	Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017 (36.1% on the average of Q3 , 2018/19)
Project Purpose				
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.		1	5-year Strategic Action Plan for NRW reduction (5YSP) is approved by the Minister of Infrastructure.	5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.
		2	Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC	NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. In the future more specific actions for NRW reduction is needed
		3	The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	The impact of NRW reduction in the pilot area is recoganised and some activities are being replicated outside pilote area
Outputs				
1	Planning capacity of NRW reduction of WASAC is enhanced.	1.1	5YSP is reviewed and updated, taking into account of the results of the Pilot Project.	Pilot projects (Kadobogo of Kacyiru Branch, Ruyenzi of New Nyarugenge Branch) have not yet completed.
		1.2	All the project achievements are shared by WASAC and other concerned parties by holding seminars.	Seminar will be planned to take place after preparation of the completion report of the Pilot Project.
2	Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2.1	More than 300 number of trainees receive training.	About 482 cumulative number of trainees were received training.
		2.2	WASAC human resource development plan includes training programs prepared by the project.	Training programs will prepared after the completion of the pilot project
3	WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3.1	NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.	Pilot Area 1: 12% (Q3) Pilot Area 2: 54% (Q3)
		3.2	Action team members share experiences at workshops regarding implementation of the pilot projects.	Workshop will be planned after evaluation of the Pilot Project 1 & 2.
		3.3	The action team prepares a completion report of the pilot project.	Completion report will be prepared after evaluation of the Pilot Project 1 & 2.
4	4 branches in Kigali establish the system to measure NRW rates accurately.	4.1	NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	・Boundary line for Isolation of 4 branches was decided. ・Exact locations for the installation of electromagnetic flowmeters were decided. ・The 23 chambers has been constructed. ・The tender procedure on procurement and installation of the equipment is delaying.

The table below shows the issues found in each activity.

Table 2.2. Achievements and issues in the project activities and countermeasures against the issues

(6th Joint Monitoring)

Activities		Achievements	Issue	Countermeasures
Output 1: Planning capacity of NRW reduction of WASAC is enhanced.				
1.4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	The inventory surveys is being updated. So far , this inventory shows that some facilities (floater valves , PRVs) requires replacement/installation .	complexity of the task to all WASAC infractructures	Completion of the survey and replacement of defected or missing equipement
1.8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX)	Branch annual action plan and budget doesn't yet clearly include specific action for the implementation of the 5YSP	Branches annual budgets are incorporated in the company budget. Some activities align with 5YSP implementation are also being considered. In the future more specific branches action plan and budget is needed.
1.12	The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	Done by WASAC utility due to the emergency to comply with the regulatory agency (RURA)		
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.				
2.2	Training on NRW management is conducted for the management team and WASAC management as necessary.	Done	Capacity Assessment of the new knowledge acquired through training has not yet been conducted	This will be done after the completion of the pilot project.
2.3	OJT is conducted on the updating of GIS data, using available GIS data base.			
2.4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.			
2.5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.			
2.6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.			
2.7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.			
Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.				
A. Preparation				
B. Activity of Pilot Area 1 Kadobogo				
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Done	Some leak detection equipments not appropriate for the majority of the existing water network condition (lack of some facilities such as valves, etc.)	use those equipement efficiently where they can be applied mote training on sophesticated one
3.14	The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.	Done	The cost- benefit analysis not yet completed . There is worry of soustainability after the end of the project .	cost benefit analysis will be completed after the completion of the pilot area 2. For the soustainability of NRW reduction in the pilot area 1, WASAC should ensure the availability of necessary budget for the continuation of routine activities within the pilot area
	Calculation of Amount of NRW and NRW rate in the DMA	Done		
C. Activity of Pilot Area 2 Ruyenzi				
3.14	The team reviews the results of Activities, and undertakes cost-benefit analysis of NRW for each Activity.	Not yet	The target is not yet reached, poor quality of pipes and high pressure still the main cause of not yet reaching the target (25%).	Continue NRW reduction in this pilot with more attention. The activities such as pressure control , leakages survey and pipe replacement should continue in the year 4

Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.				
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.	not yet done	Delay of procurement of equipment of the monitoring system.	JICA should speed up the procurement process.
4.5	System input to each of 4 branches is measured.	not yet done	Delay of procurement of equipment of the monitoring system	JICA should speed up the procurement process.

General

	Awareness of the NRW activities	In progress	this is a continous process wich can not be completed at once	need to continue awareness campaign

Inputs	Achievements	Issue	Countermeasures
Equipment Handover to WASAC	Done	None	None
Training in Japan (15 Persons)	Done	None	None
In-country/Third country Training (2 persons)	Done	None	None

2.2 Extension of activities outside the pilot areas

It is considered necessary to extend the outputs (facilitate the implementation) of the activities implemented up to the third year in the service area of WASAC in the fourth year. WASAC requested JICA to implement the following three activities for the extension in the fourth SC meeting in May 2019. It is necessary to implement these activities steadily to establish a foothold for the extension. The extension of the activities mentioned below to the branches other than those in the pilot project areas will be facilitated for the achievement of the project purpose and overall goal.

1) Functional survey of reservoirs and pressure reducing tanks (Output 1-4)

After the existing reservoirs and pressure reducing tanks have been inspected, some of the malfunctioning ones will be repaired (with the installation of floater valves).

2) Water pressure control (Output 1-11)

Measures to control water pressure (*i.e.*, installation of PRVs and replacement of water supply and distribution pipes) will be implemented at multiple sites in areas where the training on water pressure control is expected to have a large effect.

3) Procurement of portable test meters (Output 1-11)

Twelve sets of test meters will be procured for the six branches in Kigali.

2.3 Updating of 5YSP (Output 1-13)

Updating the contents is now required in order to reflect the lessons learned from the activities of the Pilot Project, etc. in the implementation program. Meanwhile, NRW reduction activities are being implemented by 20 branches, but it is necessary that each branch formulate specific implementation activities planned, and establish a budget plan.

2.4 Organizational capacity development for the implementation of NRW reduction activities (Output 1-6)

It is considered necessary to improve the organizational capacities of WASAC in the monitoring and analysis of NRW data, preparation of plans for activities, analysis of customer data, maintenance of meters, implementation of measures against the high water pressure and leakage survey and detection.

It is necessary to transfer the technology for the calculation and analysis of NRW rates to the staff members of WASAC in charge of the calculation of NRW rates and NRW data analysis. As WASAC has not recruited new staff members, the technology transfer is to be implemented in the current organizational structure for the time being. It is considered natural that WASAC staff members enhance the awareness of the need for organizational capacity development by themselves during the technology transfer.

The JICA expert has calculated the monthly NRW rates using the data of the billed water consumption in the commercial database system and measurements of the quantity of water distributed in the pilot areas and analyzed the rates. The NRW Department was to recruit a staff member for the data analysis, the department does not even have a concrete plan for the recruitment. A method to incorporate the data of new customers into the calculation of NRW rates (or to give DMA codes to the new customer data) is yet to be prepared.

2.5 Manual preparation

A manual will be prepared based on the results of the project activities, for use as a tool for disseminating the NRW reduction activities within WASAC. WASAC formed a manual preparation team in the end of January and the team is preparing the manual. The team is expected to complete the preparation in July.

2.6 Monitoring system construction

A system (system for monitoring the quantities of water distributed) for measuring the NRW rate in each of the branches in Kigali shall be constructed. The procurement by JICA is a half year behind the procurement schedule revised at the third SC meeting in August 2018 (held during the visit of a JICA monitoring mission). An explanation was presented and a M/M was concluded on the rescheduling of the procurement in the fourth SC meeting. It is essential to take measures to facilitate the procurement and installation.

NRW rates are to be calculated with the data of the quantities of water distributed collected in the system. Microsoft Excel will be used for the calculation. As there will be only three months between the

completion of the installation in the revised schedule and the conclusion of the project in June 2020, the training on the measurement after the completion of the construction of the system will have to be implemented in the form of intensive training to be completed in this short period. The final decision on the time of the installation will be made in the fifth SC meeting scheduled for October 2019.

2.7 Cross-organizational activities in WASAC

It is important that awareness of the NRW activities be shared throughout the whole organization of WASAC. Depending on the department, there is a tendency towards low awareness of participation in the Project due to being busy with day-to-day work. The actions of the management team and the project monitoring need to be more active.

3. Delay of Work Schedule and/or Problems

The installation of the equipment of the monitoring system is scheduled to be completed by March 2020. No further delay in the installation will be tolerated.

II. Project Monitoring Sheet I & II

As attached.

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 6

Implementing Agency: WASAC

Dated May 20, 2019

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2020/7/30

Project Site: 6 Branches in Kigali city（Kacyiru, Nyamirambo, Gikondo, Nyarugenge, Remera and Kanombe ） **Model Site:**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement
Overall Goal				
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city （year 2022/23 : 25 %)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017 (36 % on the average of Q3 , 2018/19)
Project Purpose				
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure	The non-revenue water section at WASAC is not subject to large scale reorganization.	5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.
	2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC	2 Annual action plan of WASAC	WASAC staff do not resign after training by the Project.	NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. In the future more specific actions for NRW reduction is needed.
	3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	3 Budget of WASAC	Large scale natural disaster dose not occur.	The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area.
Outputs				
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project.	1-1 Records of the project		Pilot projects (Kadobogo of Kacyiru Branch, Ruyenzi of New Nyarugenge Branch) have not yet completed.
	1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-2 Records of the project		Seminar will be planned to take place after preparation of the completion report of the Pilot Project.
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training.	2-1 Records of the project		482 cumulative number of trainees were received training.
	2-2 WASAC human resource development plan includes training programs prepared by the project.	2-2 Records of the project		Training programs will prepared after the completion of the pilot project
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.	3-1 Records of the project		Pilot Area 1: 12% (Q3) Pilot Area 2: 54% (Q3)
	3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.	3-2 Records of the project		Workshop will be planned after evaluation of the Pilot Project 1 & 2.
	3-3 The action team prepares a completion report of the pilot project.	3-3 Survey plans for locations outside the pilot project		Workshop will be planned after evaluation of the Pilot Project 1 & 2.
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		・Boundary line for Isolation of 4 branches was decided. ・Exact locations for the installation of electromagnetic flowmeters were decided. ・The 23 chambers has been constructed. ・The tender procedure on procurement and installation of the equipment is delaying.

Activities	Inputs		Pre-Conditions
	The Japanese Side	**The Rwanda Side**	
1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.			
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser／Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.	GIS	Management team members	
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	GIS data should continue to be updated
1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Leak detection	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11 The management team facilitates implementation and the monitoring of the 5YSP.			
1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.			
1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-1 Training materials on NRW control are prepared.	Training in the 3rd country	Training room with the capacity of about 20 persons	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.		Space for training on pipe repair and service pipe connection（40㎡）	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Equipment for training on pipe repair and service pipe connection		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Gate valve, flow meter, and customer meter for Pilot Project	3 Local cost	
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Leak detection equipment	Cost for administering the Project (utilities for experts offices, internet services)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Equipment for survey (Mobile GPS etc.)	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8 Training materials on NRW are reviewed and updated.	Pipes and related fittings for service pipe replacement in Kadobogo	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	PRV fittings in pilot area	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali		
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Vehicles and photocopy for Japanese experts		
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	4 Facility provision		
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Chambers (4) for Pilot areas		
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.	Chambers (23) for Equipment Monitoring System		
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8 The action team conducts measures for reducing surface leakage (visible leakage).			
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12 The action team conducts measures for reducing high water pressure.			
3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			
3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.			
3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.			
3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.			
3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.			
4-4 Chambers are constructed as appropriate.			
4-5 System input to each of 4 branches is measured.			
4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 6
Dated May 20, 2019

Project Title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs	Plan / Actual	1st Year (16/17)	2nd Year (17/18)	3rd Year (18/19)	4th Year (19/20)	Remarks		
		I II III IV	I II III IV	I II III IV	I II III IV			
Expert		8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6			
Chief Adviser/Non-Revenue Water Management (Otani)	Plan							
	Actual							
Adviser/Non-Revenue Water Management (Higuchi)	Plan							
	Actual							
NRW Reduction Plan 1(1)(Suzuki/Yamaguchi/Toyoda)	Plan							
	Actual							
NRW Reduction Plan 1(2)(Yoda)	Plan							
	Actual							
NRW Reduction Plan 2(1)(Toyoda)	Plan							
	Actual							
NRW Reduction Plan 2(2)(Tsutsui)	Plan							
	Actual							
Geographic Information System: GIS (Horishita)	Plan							
	Actual							
Hydraulic Analysis (Ooe)	Plan							
	Actual							
Leak Detection (Takahashi)	Plan							
	Actual							
Pipe Repairing and Service Connection(1)(Momozono)	Plan							
	Actual							
Pipe Repairing and Service Connection(2)(Takashima)	Plan							
	Actual							
Information and Communication Technology: ICT (Brouwer)	Plan							
	Actual							
Long Term Expert (Mayusumi)	Plan							
	Actual							
Equipment								
Lot 1: Equipment for training on pipe repair and service pipe connection	Plan					Handed over on Feb. 28, 2019		
	Actual							
Lot 2: Pilot Projects (Gate valve, flow meter, and customer meter)	Plan					Handed over on Feb. 28, 2019		
	Actual							
Lot 3: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.)	Plan					Handed over on Feb. 28, 2019		
	Actual							
Lot 4: Equipment for survey (Mobile GPS, Potable Test meter etc.)	Plan					Handed over on Feb. 28, 2019		
	Actual							
Lot 5: Pipe and related fittings for service pipe replacement in Kadobogo	Plan					Handed over on Feb. 28, 2019		
	Actual							
Lot 6: PRV fittings in Pilot area	Plan					Handed over on Feb. 28, 2019		
	Actual							
Lot 7: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)	Plan					Not yet procured	Re-bidding procedure by JICA is in process	
	Actual							
Lot 8: Vehicles and photocopy for Japanese experts	Plan					Not yet handed over	This will be handed over at the end of the Project	
	Actual							
Training in Japan								
15 persons will be trained in Japan (5, 5, 5)	Plan					Done		
	Actual							
In-country/Third country Training								
2 persons will be trained in Kenya	Plan					Done		
	Actual							

Activities	Sub-Activities	Plan / Actual	1st Year (16/17)	2nd Year (17/18)	3rd Year (18/19)	4th Year (19/20)	Achievements	Issue	Countermeasures
			I II III IV	I II III IV	I II III IV	I II III IV			
Output 1: Planning capacity of NRW reduction of WASAC is enhan			7 8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6			
1.1	A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.	Plan					Members of the Team were appointed in August 2016. Some change in September 2017.	None	None
		Actual							
1.2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	Plan					Questionnaire survey, Site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems.	None	None
		Actual							
1.3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan					Discussion in a series of Workshops. Framework of Action Plan was approved in the seminar on May 29, 2017	None	None
		Actual							
1.4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan					The inventory surveys is being updated. So far , this inventory shows that some facilities (floater valves , PRVs) requires replacement/installation .	Complexity of the task to all WASAC infrastructures.	Completion of the survey and replacement of defected or missing equipment
		Actual							
1.5	Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP	Plan					Draft Final report of 5YSP was approved at the second SC on Oct. 12, 2017	None	None
		Actual							
1.6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan					The organization recognized the importance of the organizational change and the structure is under review by senior management	None	None
		Actual							
1.7	The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Plan					A yearly implementation schedule for each specific actions and its priority were prepared.	None	None
		Actual							
1.8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan					Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX)	Branch annual action plan and budget doesn't yet clearly include specific action for the implementation of the 5YSP	Branches annual budgets are incorporated in the company budget. Some activities align with 5YSP implementation are also being considered. In the future more specific branches action plan and budget is needed.
		Actual							
1.9	The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan					5YSP was officially approved by the Board of Directors on April 27, 2018.	None	None
		Actual							
1.10	The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan					5YSP was shared at the SC on October 12, 2017. Approved 5YSP by both management and BoD. Explained at each Branch from April to July 2018. Workshop was held on July 19, 2018	None	None
		Actual							
1.11	The management team facilitates implementation and the monitoring of the 5YSP.	Plan					Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018. Monitoring was conducted for 2018/19 Q1,Q2 and Q3 by monthly report.	None	None
		Actual							
1.12	The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	Plan					Done by WASAC utility due to the emergency to comply with the regulatory agency (RURA)	None	None
		Actual							
1.13	The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan					In Process	None	None
		Actual							
	Seminars are organized to present all the	Plan							

1.14	achievements of the project for WASAC and other concerned parties.	Actual	Not yet	None	None
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.			Achievements	Issue	Countermeasures
2.1	Training materials on NRW control are prepared.	Plan / Actual	Done	None	None
2.2	Training on NRW management is conducted for the management team and WASAC management as necessary.	Plan / Actual	Done	Capacity Assessment of the new knowledge acquired through training has not yet been conducted	This will be done after the completion of the pilot project.
2.3	OJT is conducted on the updating of GIS data, using available GIS data base.	Plan / Actual			
2.4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan / Actual			
2.5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan / Actual			
2.6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Plan / Actual			
2.7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan / Actual			
2.8	Training materials on NRW are reviewed and updated.	Plan / Actual	In process	same as Activity 3.18	None
2.9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan / Actual	Not yet	None	None
Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.			Achievements	Issue	Countermeasures
A. Preparation					
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Plan / Actual	Member of the Team were appointed in August 2017	None	None
3.2	The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Plan / Actual	Done	None	None
3.3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	Plan / Actual	Done	None	None
3.4	The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Plan / Actual (Procurement of Equipment and Construction of Chamber)	Flow meters and pressure gauges were installed in the meter chambers by May 2017.	None	None
B. Activity of Pilot Area 1 Kadobogo					
3.5	The action team establishes the baseline NRW rate of Pilot Area 1.	Plan / Actual	Baseline: Mean value of June, July 2017 NRW Rate is: 37.3%	None	None
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Plan / Actual	The existing 327 customer meters were replaced with the new one by the result of on-site meter test (total surveyed 1,172).	None	None
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	Effect was evaluated on three comparisons cases of before and after replacement. 1. Total meter error , 2. Consumption volume of replaced meters.	None	None
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan / Actual	In process as daily routine work of Branch office	None	None
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual	Done	None	None
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan / Actual	Done	Some leak detection equipment not appropriate for the majority of the existing water network condition (lack of some facilities such as valves, etc.)	Use those equipment efficiently where they can be applied mote training on sophisticated one.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual	Done	None	None
3.12	The action team conducts activities for reducing high water pressure.	Plan / Actual	PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block.	None	None
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan / Actual	The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.	None	None
3.14	The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.	Plan / Actual	Done	The cost- benefit analysis not yet completed. There is worry of sustainability after the end of the project .	Cost benefit analysis will be completed after the completion of the pilot area 2. For the sustainability of NRW reduction in the pilot area 1, WASAC should ensure the availability of necessary budget for the continuation of routine activities within the pilot area.
3.15	The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Aria 1, and submits it to the management team.	Plan / Actual	Not yet	None	None
3.16	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.	Plan / Actual	Not yet	None	None
C. Activity of Pilot Area 2 Ruyenzi					
3.5	The action team establishes the baseline NRW rate of Pilot Area 2.	Plan / Actual	Baseline: Mean value of March, April 2018 Original: 68.4%	None	None
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 2.	Plan / Actual	General meter visual inspection for all customers 1,703 was conducted. In this, 135 were replaced by the result of on-site meter test.	None	None
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	The result of meter test shows that the effect of meter replacement was minus but quite negligible.	None	None
		Plan			

3.8	The action team conducts activities for reducing surface leakage (visible leakage).	Actual	In process	None	None
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan Actual	In process	None	None
3.10	The action team conducts activity for reducing underground leakage (invisible leakage).	Plan Actual	In process	None	None
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan Actual	Step test was conducted in February, 2019. The result shows that most critical area of leakage is high pressure area by bypass.	None	None
3.12	The action team conducts measures for reducing high water pressure	Plan Actual	Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept. , one in RY2 in Oct., 2018.	None	None
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan Actual	The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. NRW rate before and after PRV adjustment was compared in A2 (Small DMA). Also, Qmnf before and after setting PRV was compared.	None	None
3.14	The team reviews the results of Activities, and undertakes cost-benefit analysis of NRW for each Activity.	Plan Actual	Not yet	The target is not yet reached, poor quality of pipes and high pressure still the main cause of not yet reaching the target (25%)	Continue NRW reduction in this pilot with more attention. The activities such as pressure control , leakages survey and pipe replacement should continue in the year 4
3.15	The team summaries activities and results from Activities, prepares the completion report on the pilot project, and submits it to the management team.	Plan Actual	Not yet	None	None
3.16	The team holds a workshop and presents the completion report of the pilot project prepared by Activities to WASAC and other concerned parties.	Plan Actual	Not yet	None	None
D. Manual and Seminar		Plan			
3.18	Action team prepares manuals on methods and use of survey equipment learned from the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.	Plan Actual	Manual Development Team was formulated. Kickoff meeting for manual development was held on January 20, 2019. A series of meeting are continued.	None	None
3.19	Action team disseminates the manual and use of survey equipment to the activity of whole branches.	Plan Actual	Not yet	None	None
Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.			Achievements	Issue	Countermeasures
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan Actual	Done	None	None
4.2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan Actual	Done	None	None
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.	Plan Actual (Procurement of Equipment; Installation of Equipment)	JICA HQ decided to carry out a re-tender after the process failed in JICA- Rwanda . JICA HQ is now in process of bid preparation.	Delay of procurement of equipment of the monitoring system.	JICA should speed up the procurement process.
4.4	Chambers are constructed as appropriate.		23 meter chambers have been constructed	None	None
4.5	System input to each of 4 branches is measured.	Plan Actual	No yet done	Delay of procurement of equipment of the monitoring system.	JICA should speed up the procurement process.
4.6	Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.	Plan Actual	Schedule is delay.	Ditto	Ditto

Duration / Phasing	Plan Actual				

Monitoring Plan	Plan / Actual	1st Year (16/17) I II III IV	2nd Year (17/18) I II III IV	3rd Year (18/19) I II III IV	3rd Year (18/19) I II III IV	Remarks		
Monitoring		7 8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6	7 8 9 10 11 12 1 2 3 4 5 6			
Steering Committee	Plan Actual (Apr. 4; Oct. 12)					SC was held on August 28, 2018. May 22, 2019		
Set-up the Detailed Plan of Operation	Plan Actual							
Submission of Monitoring Sheet	Plan Actual							
Monitoring Mission from Japan	Plan Actual					In May 2019 by JICA HQ		
Joint Monitoring	Plan Actual							
Post Monitoring	Plan Actual							
Reports/Documents								
Inception Report	Plan Actual							
Progress Report	Plan Actual							
Project Completion Report	Plan Actual							
Public Relations								
Seminars and Workshops	Plan Actual							

PM Form 3-1　Monitoring Sheet Summary

TO CR of JICA　RWANDA　OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet ：Ver.7（Term: July, 2017 – November, 2019: 2nd Phase）

Name: Shigeo OTANI

Title: Chief Advisor/ Non-Revenue Management

Submission Date: November 19, 2019

I. Summary

1 Progress

1-1 Progress of Inputs

1-1-1 Japan Side

(1) List and Assignment Terms of Japanese Experts

a. Working in Rwanda

Table 1.1 Assignment Term in Rwanda (Phase 2) Working in Japan

	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2017/8/5	2017/10/16	2.43
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/9/18	1.50
			2018/10/20	2018/11/29	1.37
			2019/1/15	2019/3/9	1.80
			2019/4/15	2019/6/2	1.63
			2019/7/15	2019/11/24	4.43
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2017/8/5	2017/9/17	1.47
			2018/5/24	2018/7/12	1.27
3	NRW Reduction Plan 1（1）	Chiaki SUZUKI/ Hiroyuki YAMAGUCHI Toru TOYODA	2017/8/5	2017/9/23	1.67
			2018/1/16	2018/3/1	1.50
			2018/5/9	2018/7/7	1.77
			2018/10/12	2018/12/27	2.57
4	NRW Reduction Plan 1（2）	Hiroyasu YODA	2017/11/8	2017/12/22	1.50
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/10/3	2.00
			2019/2/18	2019/4/6	1.60
5	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2017/8/5	2017/9/3	1.00
			2019/10/11	2019/11/30	1.70
6	Leak Detection	Junichi TAKAHASHI	2017/12/3	2018/2/15	2.50
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2018/2/5	2018/4/5	2.00
8	ICT	Marcel Brouwer			
Total MM					39.71

Note: Man Month (MM)

b. Working in Japan

Table 1.2 Assignment Term in Japan

No.	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2018/6/4	2018/6/8	0.25
			2019/6/24	2019/6/28	0.25
5	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2019/9/13	2019/10/8	0.85
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2017/8/1	2017/8/10	0.40
			2017/10/30	2017/11/9	0.40
Total M/M					1.05

Details of each expert's assignment are shown in the Plan of Operation (see Project Monitoring Sheet-II "Plan of Operation").

(2) List of Equipment Provided for the Project

Table 1.3 (1) List of Equipment

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Output 2	Materials and equipment for training for pipe repairing and service connection	set	1	Consultant	May. 2017 Completed	in process
Lot 2	Output 3	Customer meter DN15mm	sets	400	Consultant	Feb. 2017 Completed	in process
Lot 3	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Consultant	May. 2017 Completed	in process
Lot 6	Output 3:	Pipes and rerated fittings for service pipe replacement in Kadobogo	set	1	Consultant	Dec. 2018 Completed	in process
Lot 7	Output 3:	PRV fittings in pilot area	set	1	Consultant	Dec. 2017 Completed	in process
Lot 4	**Output 4: Isolation of 4 Branch**	**Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.**	**set**	**1**	**JICA office**	**June 2019 Scheduled**	**not yet**
Lot 5	**Vehicles for JICA use**	**Minibus May 31, 2019 Pickup June 30, 2020**	**Units**	**2**	**JICA office**	**Jan. 2017 Completed**	**not yet**
Lot5	**Photocopy Machine**	**June 30, 2020**	**Unit**	**1**	**JICA office**	**August 2016**	**not yet**
Lot 8	**Equipment for Additional Activities**	**PRV, Float Valve and Fitting**	**Set**	**1**	**Consultant**	**November 2019**	**not yet**
Lot 9	**Potable Test Meter**	**On-site Test Meter**	**Unit**	**26**	**Consultant**	**November 2019**	**not yet**

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity		Schedule	Handover to WASAC

Lot 8	Output 2: Leak detection equipment（for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	sets	3	JICA HQ	Jul. 2017 Completed	not yet
Lot 9	Survey Equipment for Output 2and 3	Potable GPS, Potable Test Meter, Residual Chlorine Test Meter, Potable Electric conductivity Meter	set	1	Consultant	Oct. 2016 Completed	not yet

Note: Those items are used for the training activity during the Project period.
The above mentioned equipment except Lot 5 should be handed over to WASAC immediately after delivery and WASAC will maintain them. The equipment of Lot 5 will be managed by the JICA Expert Team during the Project period and shall be handed over to WASAC at the end of the Project period

(3) List of Facilities Provided for the Project

Table 1.3 (2) List of Equipment

Facilities to be Provided

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Chambers for Pilot Areas	2 chambers for Pilot Area1 1 chamber for Pilot Area 2	set	1	Consultant	May. 2017 Completed	Completed
Lot 2	Chambers for Monitoring System	Customer meter DN15mm	set	1	Consultant	Sept. 2018 Completed	Completed
Lot 3	Monitoring System		set	1	Consultant	In progress	Not yet
Lot 4	Chambers for Pilot Area	Kadobogo 1 (PM3)	set	1	Consultant	September 2018	Not yet
Lot 5	Chambers for Pilot Area	Ruyenzi 5 (PRV1, 2, 4, 5 and 63mm Valve)	set	1	Consultant	October 2019	Not yet
Lot 6	Chambers for Additional Activities	PRV at 12 sits	set	1	Consultant	In progress	Not yet

1-1-2 Rwanda Side

(1) Counterpart

See Project Progress Report. (Part3)

Table 1.5　Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Celestin MWAMBUTSA	Head of water distribution services, WOS, UWSS
Output 3	Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

(2) Facilities

- Office space for Japanese experts at WASAC Head Office, office furniture

- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

(3) Local Cost

- Cost for administering the Project (utilities for expert offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project for 2nd Phase

Start-up Meeting of the Project was held Aug. 9, 2017 with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Submission of Progress report (Part 1), Monitoring Sheet (Ver. 3), Work Plan (Ver. 3)
- Brief explanation of Project implementation for Phase 2
- Schedule of Management Team Meeting (Joint Monitoring) and Steering Committee (SC)

(2) Management Meeting (Joint Monitoring)

In the third joint monitoring conducted at the management team meeting held on August 9, 2017, the Work Plan of Phase 2 and Monitoring Sheet (Ver.3) were submitted. The topics for discussion of the past joint monitoring are shown below.

Table 1.6　Main items checked and actions taken in the joint monitoring

No.	Implementation period	Main items checked and actions taken	Changes to R/D, PDM, PO, etc.
Version 1	September 15, 2016	None in particular	None
Version 2	March 15, 2017	・ The activities of Output 1 (Activities 1.2 to 1.10) have been extended for about 3 months → To be completed by the end of August 2017 ・ The activities of Output 4 (Activity 4.3) has been extended due to the delay in procurement of equipment → Activities to continue in Phase 2	PO Version 1 →PO Version 2
Version 3	Aug 9, 2017	・Joint Monitoring Progress of each activity (preparation of 5YSP, Technical training, Pilot project, Isolation of 4 branches, Equipment procurement, others) ・Work Plan for Phase 2 Outputs ・Contents and implementation schedule of the Pilot Project	PO Version2 →PO Version3
Version 4	August 20, 2018 (before Monitoring	Progress until August 2018 of Phase2 Achievements, issues and challenges	Revision of RD, PDM, PO

	Mission)	Proposal of amendment of PO	
Version 5	Scheduled at May 2019 (before Monitoring Mission)	Progress until May 2019 of Phase2 Achievements, issues and challenges Proposal for 4th year of the Project	
Version 6	May 22, 2019	Progress until May 2019 of Phase2 Achievements, issues and challenges	Revision of PO
Version 7	November 19, 2019	Progress until November 2019 of Phase2 Achievements, issues and challenges	

(3) Steering Committee (SC)

The results of holding SC meetings and future plans and agenda are as shown in the table below.

Table.1.9 The held time of the SC meeting and the agenda

Time	Holding time	Theme, contents
1st	April 3, 2017	・Discussion of the work plan (WP1), approval ・Confirmation of the Rwandan side burden matter
2nd	October 12, 2017	・Progress confirmation of the project ・Common knowledge of the NRW reduction 5YSP ・Approval of the second work plan ・About the enforcement of the project evaluation
3rd	August 28, 2018August 28, 2018 At the time of Project Monitoring by JICA	・Result of Joint Monitoring ・ Procurement and Installation Plan of the Equipment for Monitoring System ・Monitoring result of the JICA Monitoring Survey Mission
4th	May 22, 2019	・ Progress of the Project ・ Rescheduling of Equipment Procurement and Installation of Output 4 ・ Additional Activities ・ Revised Work Plan for Phase 2
5th	At the time of 6 months before project completion.	・ Progress of the Project ・ Extension of the project period
6th	At the time of project completion, scheduled in May 2019	・Result of Joint Monitoring ・Monitoring result of the JICA Monitoring Survey Mission

(4) Weekly Meeting

As a rule, PIM meetings are held basically at the end of every week and the activities for the week are reported, the activities scheduled for the following week are confirmed and pending issues, matters of concern, requests, etc., are discussed. The meetings are also utilized as a venue for training through seminars and workshops on matters proposed by the experts, etc. Meetings have been held 77 times as of the end of October 2019 (including thirty times in Phase 1).

(5) Project Progress Report (Part 1)

Project Progress Report (Part 3) was submitted to JICA and WASAC in July 2019.

1-2-2: Training in Japan and in the 3rd Country

(1) Training in Japan

Table 1.10 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5	- Introduction to water service management and NRW - Outline of water facilities in Yokohama and Kobe Cities and other matters
2	August 14 to 30, 2017	Business affairs and GIS matter	5	- Introduction to water service management and NRW - Customer information management, meter management and reading, and water service management - Examples of how local governments utilize GIS, purposes of use, and other matters
3	Nov. 13 to 30, 2017	Technical matter	5	Introduction to NRW, pressure management, leak detection, distribution management, and other matters

(2) Training in the 3rd country

Training in the 3rd country was conducted in Kenya as shown in the table below.

Table 1.11 Training in the 3rd country

No	Timing	Field of training	Trainees	Training Themes
1	May 7 to 10, 2018	Management Team	2	An introduction and discussion of activity on NRW reduction carried out in each other's countries.

1-2-3: Activities of Output

【Activities of Output 1】:

Planning capacity of NRW reduction of WASAC is enhanced.

1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.

Members of the Team were appointed in August 2016. Some change in September 2017.

See Project Progress Report (Part 3).

1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

Questionnaire survey, site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems. These have done.

See Project Progress Report (Part 3).

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

Discussion in a series of Workshops have been conducted. Framework of Action Plan was approved in the seminar on May 29, 2017. See Project Progress Report (Part 3).

1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

The inventory surveys for pressure control, reservoir are being updated. This inventory shows that some facilities (floater valves, PRVs) which are required replacement/ installation. The facilities for argent task have been selected and equipment procurement and installation work is in process.

The reservoir survey should be continued to remaining all in the Kigali city, but time is needed for implementation it.

Pressure control for up-countries branches are required. Making the survey schedule and carry out the activity.

See Project Progress Report. (Part3)

1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP.

Draft Final report of 5YSP was approved at the second SC on Oct. 12, 2017

See Project Progress Report (Part 3).

1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

The organization recognized the importance of the organizational change and the structure is under review by senior management. See Project Progress Report (Part 3).

1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP

A yearly implementation schedule for each specific actions and its priority were prepared.

See Project Progress Report (Part 3).

1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.

Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX)

NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. Some activities align with 5YSP implementation are also being considered.

In the future more specific actions for NRW reduction is needed.

The budget of NRW activity was decided in WASAC Action Plan, but that budget is not allocated at an

implementation level.

Managing side should more practical budget allocation in line with an branch office demand on NRW reduction activities.

See Project Progress Report (Part 3).

1-9　The management team prepares the 5YSP that summarizes the achievements from Activities 1-1 to 1-7.

5YSP was officially approved by the Board of Directors on April 27, 2018.

See Project Progress Report (Part 3).

1-10　The management team holds seminars and presents 5YSP (Activity 1-8) for WASAC and other concerned parties.

5YSP was shared at the SC on October 12, 2017. Approved 5YSP by both management and BoD. Explained at each Branch from April to July 2018.

Workshop was held on July 19, 2018

See Project Progress Report (Part 3).

1-11　The management team facilitates implementation and the monitoring of the 5YSP.

Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018. Monitoring has being conducted from 2018/19 at every Q by monthly report.

As a additional activity, procurement of 12 on-site test meter is decided in 4th SC of May 2019.

See Project Progress Report (Part 3).

1-12　The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.

Done by WASAC utility due to the emergency to comply with the regulatory agency (RURA)

See Project Progress Report (Part 3).

1-13　The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

Budget of WASAC Action Plane was approved. But, budget is not sufficient for implementation for all activities of 5YSP.

See Project Progress Report (Part 3).

1-14　Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

Seminar will be scheduled in year 2020

【Activities of Output 2】:

Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2-1 Training materials on NRW control are prepared.

Done. See Project Progress Report (Part 3).

2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.

Done. See Project Progress Report (Part 3).

2.3　OJT is conducted on the updating of GIS data, using available GIS data base.

Done. See Project Progress Report (Part 3).

2.4　OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

Done. See Project Progress Report (Part 3).

2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

Done. See Project Progress Report (Part 3).

2.6　In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

Done. See Project Progress Report (Part 3).

2.7　In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

Done. See Project Progress Report (Part 3).

2-8　Training materials on NRW are reviewed and updated.

Updating will be carried out through implementation of the pilot project of Output 3. Training materials will be reviewed and updated based on the result that practiced in the pilot project activities.

See Project Progress Report (Part 3).

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

The development of the programs and training courses will be planned in 2020. These should be incorporated in a training plan in Supporting Service Department (SSD) and be intended it for all branch personnel. See Project Progress Report (Part 3).

【Activities of Output 3】

: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

A. Project Preparation

3-1 The action teams are organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.

Member of the Team were appointed in August 2017. See Project Progress Report (Part 3).

3-2 The action team grasps the current situations of Pilot Area 1 and Pilot Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.

Done. See Project Progress Report (Part 3).

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Pilot Area 2.

Done. See Project Progress Report (Part 3).

3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1and 2.

Done. See Project Progress Report (Part 3).

3-5 The action team establishes the baseline NRW rate of Pilot Area 1 and Area2

Done. See Project Progress Report (Part 3).

Area1: Baseline: Mean value of June, July 2017. NRW Rate is: 37.3%

Area2: Baseline: Mean value of March, April 2018. Original: 68.4%

B. Activity of the Pilot Area

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water

balance of International Water Association (IWA) for Pilot Area 1 and Area 2.

Area1: The existing 327 customer meters were replaced with the new one by the result of on-site meter test (total surveyed 1,172).

Area2: General meter visual inspection for all customers 1,703 was conducted. In this, 135 were replaced by the result of on-site meter test.

See Project Progress Report (Part 3).

3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness

Area1: Effect was evaluated on three comparisons cases of before and after replacement. 1. Total meter error , 2. Consumption volume of replaced meters.

Area 2: The result of meter test shows that the effect of meter replacement was minus but quite negligible.

See Project Progress Report (Part 3).

3-8 The action team conducts measures for reducing surface leakage (visible leakage).

Area 1: In process as daily routine work of Branch office

Area2: Large quantity of the existing leakage was measured. Visible leakages were found at 16 places in March, 14 places in July and August.

See Project Progress Report (Part 3).

3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

Done. See Project Progress Report (Part 3).

3-10 The action team conducts measures for reducing underground leakage (invisible leakage).

Area 1:Done.

Area2: Step test was conducted during may to July 2019.

See Project Progress Report (Part 3).

3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

Area 1:Done

Aria 2: Qmnf measurement was conducted during June to September 2019.

See Project Progress Report (Part 3).

3-12 The Action team conducts measures for reducing high water pressure.

Area 1: PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block. PRV at PM1 was set in September 2019.

Aria 2 : Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept. , one in RY2 in Oct., 2018. Additionally, one each in RY1 and RY3. Ball valve in RY1.

See Project Progress Report (Part 3).

3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.

Area 1 : The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.

Aria 2 : The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. NRW rate before and after PRV adjustment was compared in A2 (Small DMA). Also, Qmnf before and after setting PRV was compared. Qmnf was measured.

See Project Progress Report (Part 3).

3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.

Area 1 : The cost-benefit analysis was done by using dada as of May 2019.

Aria 2 : Not yet

See Project Progress Report (Part 3).

3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project, and submits it to the management team.

Area1: Draft of completion the draft report was completed in October. The action team will finalize completion report.

Area 2: Not yet.

See Project Progress Report (Part 3).

3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.

Not yet.

3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.

3-18　Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

Manual Development Team was formulated. Kickoff meeting for manual development was held on January 20, 2019. A series of meeting are continued. The work has been interrupted from May 2019. Manual should will be completed.

See Project Progress Report (Part 3).

3-19. Action team disseminates the manual and use of survey equipment to the activity of whole branches.

Not yet.

【Activities of Output 4】:

4 branches in Kigali establish the system to measure NRW rates accurately.

4-1　Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

Done. See Project Progress Report (Part 3).

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

Done. See Project Progress Report (Part 3).

4-3. Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.

JICA HQ decided to carry out a re-tender after the process failed in Rwanda . Bid was conducted in Japan. Japanese engineering company started the work from October 2019.

See Project Progress Report (Part 3).

4-4. Chambers are constructed as appropriate.

Done. See Project Progress Report (Part 3).

4-5. System input to each of 4 branches is measured.

This work will carry out after completion of the monitoring system.

According to the work schedule, monitoring system will be completed in June, 2020. The remaining period until July is not enough for the OJT of NRW rate calculation.

SC for discussion about extension of the project period will be taken place in January, 2020.

4-6. Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.

The calculation of NRW rate in each branch will be started after construction of the monitoring system.

1-3 Achievement of Output

1)　Plannning Capacity of NRW reduction

5YSP is updated depending on the progress of the pilot project. Activity of Area 1 was completed in June, 2019. Area 2 was completed in October, 2019.

5YSP is updated depending on the progress of the pilot project. Activity of Area 1 was completed in June, 2019. Area 2 was completed in October, 2019.

Seminar will be planned to take place after preparation of the completion report of the Pilot Projects.

2)　Basic knowledge, skills and technique on NRW control

482 cumulative number of trainees were received training.

Training programs will prepared after the completion of the pilot project manual.

3)　WASAC learned how to conduct NRW reduction measures though the pilot project

Pilot Area 1:　26% (Q1 of 2019/20)

Pilot Area 2:　53% (Q1 of 2019/20)

Workshop will be planned after preparation of the Pilot Project Completion Reports.

Draft of completion report of Area 1 was prepared.　The report of Area 1 will be prepared beginning of 2020.

・Boundary line for Isolation of 4 branches was decided.

・Exact locations for the installation of electromagnetic flowmeters were decided.

・The 23 chambers has been constructed.

・The work for procurement and installation of the equipment has been started October 2019. The system will be completed in June of 2020.

・OJT on NRW rate calculation using monitoring system data will be carry out after construction of monitoring system.

1-4 Achievement of the Project Purpose

5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.

NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. In the future more specific actions for NRW reduction is needed.

The budget of NRW reduction activity was decided in WASAC Action Plan, but that budget is not allocated at an implementation level.

The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area.

1-5 Achievement of Overall Goal

Achievement status of the Project outputs is observed according to the PDM indicators. Refer to Project Monitoring Sheet I (PM Form 3-2). Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017 (38.8 % on the average of 2018/19)

1-6 Changes of Risks and Actions for Mitigation

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

1-7 Progress of Actions undertaken by JICA

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment was procured in July 2017.
- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is behind the schedule.

1-8 Progress of Actions undertaken by Rwanda side

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Preparation of 5-year Strategic Action Plan for NRW reduction.
- Joint visit JICA-WASAC of WASAC’s upcountry branches.
- Training in Japan
- Training in the third Country

1-9 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

None

2. Delay of Work Schedule and/or Problems

According to the work schedule, monitoring system of Output 4 will be completed in June, 2020. The remaining period of the Project until July 2020 is not enough for the OJT of NRW rate calculation. SC for discussion about extension of the project period will be taken place in January, 2020. **R/D and PO will be revised based on the result of the SC**

II. Project Monitoring Sheet I & II

As attached.

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 7

Implementing Agency: WASAC

Dated November 19, 2019

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2020/7/30

Project Site: 6 Branches in Kigali city（Kacyiru, Nyamirambo, Gikondo, Nyarugenge, Remera and Kanombe ）　　**Model Site:**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement
Overall Goal				
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city （year 2022/23 : 25 %)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017 (38.8 % on the average of 2018/19)
Project Purpose				
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure	The non-revenue water section at WASAC is not subject to large scale reorganization.	5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.
	2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC	2 Annual action plan of WASAC	WASAC staff do not resign after training by the Project.	NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. In the future more specific actions for NRW reduction is needed. The budget of NRW reduction activity was decided in WASAC Action Plan, but that budget is not allocated at an implementation level.
	3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	3 Budget of WASAC	Large scale natural disaster dose not occur.	The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area.
Outputs				
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project.	1-1 Records of the project		5YSP is updated depending on the progress of the pilot project. Activity of Area 1 was completed in June, 2019. Area 2 was completed in October, 2019.
	1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-2 Records of the project		Seminar will be planned to take place after preparation of the completion report of the Pilot Projects.
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training.	2-1 Records of the project		482 cumulative number of trainees were received training.
	2-2 WASAC human resource development plan includes training programs prepared by the project.	2-2 Records of the project		Training programs will prepared after the completion of the pilot project manual.
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.	3-1 Records of the project		Pilot Area 1: 26% (Q1 of 2019/20) Pilot Area 2: 53% (Q1 of 2019/20)
	3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.	3-2 Records of the project		Workshop will be planned after preparation of the Pilot Project Completion Reports.
	3-3 The action team prepares a completion report of the pilot project.	3-3 Survey plans for locations outside the pilot project		Draft of completion report of Area 1 was prepared. The report of Area 1 will be prepared beginning of 2020.
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		・Boundary line for Isolation of 4 branches was decided. ・Exact locations for the installation of electromagnetic flowmeters were decided. ・The 23 chambers has been constructed. ・The work for procurement and installation of the equipment has been started October 2019. The system will be completed in June of 2020. ・OJT on NRW rate calculation using monitoring system data will be carry out after construction of monitoring system.

Activities	Inputs		Pre-Conditions
	The Japanese Side	**The Rwanda Side**	
1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.			
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser／Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.	GIS	Management team members	
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	GIS data should continue to be updated
1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Leak detection	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11 The management team facilitates implementation and the monitoring of the 5YSP.			
1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.			
1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-1 Training materials on NRW control are prepared.	Training in the 3rd country	Training room with the capacity of about 20 persons	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.		Space for training on pipe repair and service pipe connection（40㎡）	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Equipment for training on pipe repair and service pipe connection		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Gate valve, flow meter, and customer meter for Pilot Project	3 Local cost	
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Leak detection equipment	Cost for administering the Project (utilities for experts offices, internet services)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Equipment for survey (Mobile GPS etc.)	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8 Training materials on NRW are reviewed and updated.	Pipes and related fittings for service pipe replacement in Kadobogo	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	PRV fittings in pilot area	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali		
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Vehicles and photocopy for Japanese experts		
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	PRVs and Float Valves for Additional Activities		
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Potable Test Meter additionally procured (26 sets)		
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.			
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	4 Facility provision		
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Flow-meter Chambers (4) for Pilot areas		
3-8 The action team conducts measures for reducing surface leakage (visible leakage).	Flow-meter Chambers (23) for Equipment Monitoring System		
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	PRV Chambers: Kadobogo (1), Ruyenzi (5), Additional for outside pilot area (12)		
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12 The action team conducts measures for reducing high water pressure.			
3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			
3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.			
3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.			
3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.			
3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.			
4-4 Chambers are constructed as appropriate.			
4-5 System input to each of 4 branches is measured.			
4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 7
Dated November 19, 2019

Project Title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs	Plan / Actual	1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)				4th Year (19/20)				Remarks		
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV			
Expert		8,9	10,11,12	1,2,3	4,5,6	7,8,9	10,11,12	1,2,3	4,5,6	7,8,9	10,11,12	1,2,3	4,5,6	7,8,9	10,11,12	1,2,3	4,5,6			
Chief Adviser/Non-Revenue Water Management (Otani)	Plan																			
	Actual																			
Adviser/Non-Revenue Water Management (Higuchi)	Plan																			
	Actual																			
NRW Reduction Plan 1(1)(Suzuki/Yamaguchi/Toyoda)	Plan																			
	Actual																			
NRW Reduction Plan 1(2)(Yoda)	Plan																			
	Actual																			
NRW Reduction Plan 2(1)(Toyoda)	Plan																			
	Actual																			
NRW Reduction Plan 2(2)(Tsutsui)	Plan																			
	Actual																			
Geographic Information System: GIS (Horishita)	Plan																			
	Actual																			
Hydraulic Analysis (Ooe)	Plan																			
	Actual																			
Leak Detection (Takahashi)	Plan																			
	Actual																			
Pipe Repairing and Service Connection(1)(Momozono)	Plan																			
	Actual																			
Pipe Repairing and Service Connection(2)(Takashima)	Plan																			
	Actual																			
Information and Communication Technology: ICT (Brouwer)	Plan																			
	Actual																			
Long Term Expert (Mayusumi)	Plan																			
	Actual																			
Equipment																		Handed Over		
Lot 1: Equipment for training on pipe repair and service pipe connection	Plan																	Feb. 28, 2019		
	Actual																			
Lot 2: Pilot Projects (Gate valve, flow meter, and customer meter)	Plan																	Feb. 28, 2019		
	Actual																			
Lot 3: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.)	Plan																	Feb. 28, 2019		
	Actual																			
Lot 4: Equipment for survey (Mobile GPS, Potable Test meter etc.)	Plan																	Feb. 28, 2019		
	Actual																			
Lot 5: Pipe and related fittings for service pipe replacement in Kadobogo	Plan																	Feb. 28, 2019		
	Actual																			
Lot 6: PRV fittings in Pilot area	Plan																	Feb. 28, 2019		
	Actual																			
Lot 7: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)	Plan																	Procurement is in process	This will be handed over at the completion of the monitoring system	
	Actual																			
Lot 8: Vehicles and photocopy for Japanese experts	Plan																	Using in project activities	This will be handed over at the end of the Project	
	Actual																			
Lot 9: PRVs and Float Valves for Additional Activities	Plan																	Procurement is in process	This will be handed over after installation.	
	Actual																			
Lot 10: Potable Test Meter additionally procured (26 sets)	Plan																	Procurement is in process		
	Actual																			
Training in Japan																				
15 persons will be trained in Japan (5, 5, 5)	Plan																	Done		
	Actual																			
In-country/Third country Training																				
2 persons will be trained in Kenya	Plan																	Done		
	Actual																			

Activities		Plan / Actual	1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)				4th Year (19/20)				Achievements	Issue	Countermeasures
	Sub-Activities		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV			
Output 1: Planning capacity of NRW reduction of WASAC is enhan			7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6			
1.1	A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.	Plan																	Members of the Team were appointed in August 2016. Some change in September 2017.	None	None
		Actual																			
1.2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	Plan																	Questionnaire survey, Site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems.	None	None
		Actual																			
1.3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan																	Discussion in a series of Workshops. Framework of Action Plan was approved in the seminar on May 29, 2017	None	None
		Actual																			
1.4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan																	The inventory surveys for pressure control, reservoir are being updated. This inventory shows that some facilities (floater valves, PRVs) which are required replacement/ installation. The facilities for argent task have been selected and equipment procurement and installation work is in	The reservoir survey should be continued to remaining all in the Kigali city, but time is needed for implementation it. Pressure control for up-countries branches are required.	Making the survey schedule and carry out the activity.
		Actual																			
1.5	Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP	Plan																	Draft Final report of 5YSP was approved at the second SC on Oct. 12, 2017	None	None
		Actual																			
1.6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan																	The organization recognized the importance of the organizational change and the structure is under review by senior management	None	None
		Actual																			
1.7	The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Plan																	A yearly implementation schedule for each specific actions and its priority were prepared.	None	None
		Actual																			
1.8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan																	Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX) NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. Some activities align with 5YSP implementation are also being considered.	In the future more specific actions for NRW reduction is needed. The budget of NRW activity was decided in WASAC Action Plan, but that budget is not allocated at an implementation level.	Managing side should more practical budget allocation in line with an branch office demand on NRW reduction activities.
		Actual																			
1.9	The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan																	5YSP was officially approved by the Board of Directors on April 27, 2018.	None	None
		Actual																			
1.10	The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan																	5YSP was shared at the SC on October 12, 2017. Approved 5YSP by both management and BoD. Explained at each Branch from April to July 2018. Workshop was held on July 19, 2018	None	None
		Actual																			
1.11	The management team facilitates implementation and the monitoring of the 5YSP.	Plan																	Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018. Monitoring has being conducted from 2018/19 at every Q by monthly report. As a additional activity, procurement of 12 on-site test meter is decided in 4th SC of May 2019.	None	None
		Actual																			

				Achievements	Issue	Countermeasures
1.12	The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	Plan / Actual		Done by WASAC utility due to the emergency to comply with the regulatory agency (RURA)	None	None
1.13	The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan / Actual		Budget of WASAC Action Plane was approved.	Budget is not sufficient for implementation for all activities of 5YSP.	None
1.14	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Plan / Actual		Not yet	None	None
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.				Achievements	Issue	Countermeasures
2.1	Training materials on NRW control are prepared.	Plan / Actual		Done	None	None
2.2	Training on NRW management is conducted for the management team and WASAC management as necessary.	Plan / Actual		Done	Capacity Assessment of the new knowledge acquired through training has not yet been conducted	This will be done after the completion of the pilot project.
2.3	OJT is conducted on the updating of GIS data, using available GIS data base.	Plan / Actual				
2.4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan / Actual				
2.5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan / Actual				
2.6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Plan / Actual				
2.7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan / Actual				
2.8	Training materials on NRW are reviewed and updated.	Plan / Actual		In process	same as Activity 3.18	None
2.9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan / Actual		Not yet	None	None
Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.				Achievements	Issue	Countermeasures
A. Preparation			7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6			
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Plan / Actual		Member of the Team were appointed in August 2017	None	None
3.2	The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Plan / Actual		Done	None	None
3.3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	Plan / Actual		Done	None	None
3.4	The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Plan / Actual	Procurement of Equipment and Construction of Chamber	Flow meters and pressure gauges were installed in the meter chambers by May 2017.	None	None
B. Activity of Pilot Area 1 Kadobogo						
3.5	The action team establishes the baseline NRW rate of Pilot Area 1.	Plan / Actual		Baseline: Mean value of June, July 2017 NRW Rate is: 37.3%	None	None
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Plan / Actual		The existing 327 customer meters were replaced with the new one by the result of on-site meter test (total surveyed 1,172).	None	None
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual		Effect was evaluated on three comparisons cases of before and after replacement. 1. Total meter error , 2. Consumption volume of replaced meters.	None	None
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan / Actual		In process as daily routine work of Branch office	None	None
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual		Done	None	None
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan / Actual		Done	Some leak detection equipment not appropriate for the majority of the existing water network condition (lack of some facilities such as valves, etc.)	Use those equipment efficiently where they can be applied mote training on sophisticated one.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual		Done	None	None
3.12	The action team conducts activities for reducing high water pressure.	Plan / Actual		PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block. PRV at PM1 was set in September 2019.	PRV of PM3 has being out of order. So the NRW rate of PM3 increased from May 2019. PRV of PM3 should be replaced with stock of WASAC central store. But, there is a difficulty of the WASAC central store managiment system.	
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan / Actual		The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.	None	None
3.14	The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.	Plan / Actual		The cost-benefit analysis was done by using dada as of May 2019.	The cost- benefit analysis is not yet completed. There is worry of sustainability after the end of the project .	The analysis will be completed after the end of the NRW reduction activities as the pilot. For the sustainability of NRW reduction, WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities.
3.15	The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Aria 1, and submits it to the management team	Plan / Actual		Draft of completion report was completed in October. The action team will finalize completion report.	None	None
3.16	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.	Plan / Actual		Not yet	None	None
C. Activity of Pilot Area 2 Ruyenzi			7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6			
		Plan		Baseline: Mean value of March,		

3.5	The action team establishes the baseline NRW rate of Pilot Area 2.	Actual	April 2018 Original: 68.4%	None	None
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 2.	Plan Actual	General meter visual inspection for all customers 1,703 was conducted. In this, 135 were replaced by the result of on-site meter test.	None	None
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan Actual	The result of meter test shows that the effect of meter replacement was minus but quite negligible.	None	None
3.8	The action team conducts activities for reducing surface leakage (visible leakage).	Plan Actual	Large quantity of the existing leakage was measured. Visible leakages were found at 16 places in March, 14 places in July and August.	None	None
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan Actual	Done	None	None
3.10	The action team conducts activity for reducing underground leakage (invisible leakage).	Plan Actual	Step test was conducted during may to July 2019.	Invisible leakage could not be found because of complexity of the existing network.	Pressure reduction is required for control of underground leakage.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan Actual	Qmnf measurement was conducted during June to September 2019.	The result shows that most critical area of leakage is high pressure area by bypass of the Ruyezi reservoir.	Pressure reduction is required for control of underground leakage.
3.12	The action team conducts measures for reducing high water pressure	Plan Actual	Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept. , one in RY2 in Oct., 2018. Additionally, one each in RY1 and RY3. Ball valve in RY1.	None	None
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan Actual	The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. NRW rate before and after PRV adjustment was compared in A2 (Small DMA). Also, Qmnf before and after setting PRV was compared. Qmnf was measured.	None	None
3.14	The team reviews the results of Activities, and undertakes cost-benefit analysis of NRW for each Activity.	Plan Actual	Not yet	The target is not yet reached, poor quality of pipes and high pressure still the main cause of not yet reaching the target (25%).	Continue NRW reduction in this pilot with more attention. The pressure control will be continue in the year 4
3.15	The team summaries activities and results from Activities, prepares the completion report on the pilot project, and submits it to the management team.	Plan Actual	Not yet	None	None
3.16	The team holds a workshop and presents the completion report of the pilot project prepared by Activities to WASAC and other concerned parties.	Plan Actual	Not yet	None	None
D. Manual and Seminar		Plan			
3.18	Action team prepares manuals on methods and use of survey equipment learned from the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.	Plan Actual	Manual Development Team was formulated. Kickoff meeting for manual development was held on January 20, 2019. A series of meeting are continued.	The work has been interrupted from May 2019.	Manual should will be completed.
3.19	Action team disseminates the manual and use of survey equipment to the activity of whole branches.	Plan Actual	Not yet	None	None
Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.			Achievements	Issue	Countermeasures
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan Actual	Done	None	None
4.2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan Actual	Done	None	None
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.	Plan Actual	JICA HQ decided to carry out a re-tender after the process failed in Rwanda . Bid was conducted in Japan. Japanese engineering company started the work from October 2019.	None	None
4.4	Chambers are constructed as appropriate.		23 meter chambers have been constructed	None	None
4.5	System input to each of 4 branches is measured.	Plan Actual	This work will carry out after completion of the monitoring system	According to the work schedule, monitoring system will be completed in June, 2020. The remaining period until July is not enough for the OJT of NRW rate calculation.	SC for discussion about extension of the project period will be taken place in January, 2020.
4.6	Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.	Plan Actual	Ditto	Ditto	Ditto

Duration / Phasing	Plan Actual	

Monitoring Plan		1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)				3rd Year (18/19)				Remarks
	Actual	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
Monitoring		7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	
Steering Committee	Plan																	
	Actual				Apr. 4		Oct. 12					Aug. 28 May 22				Jan **		
Set-up the Detailed Plan of Operation	Plan																	
	Actual																	
Submission of Monitoring Sheet	Plan																	
	Actual																	
Monitoring Mission from Japan	Plan																	
	Actual																	
Joint Monitoring	Plan																	
	Actual																	
Post Monitoring	Plan																	
	Actual																	
Reports/Documents																		
Inception Report	Plan																	
	Actual																	
Progress Report	Plan																	
	Actual																	
Project Completion Report	Plan																	
	Actual																	
Public Relations																		
Seminars and Workshops	Plan																	
	Actual																	

Appendix 3. Project Monitoring Sheet Ver.8

TO CR of JICA RWANDA OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet : Ver. 8 (Term: July, 2017 – March, 2021: 2nd Phase)

Name: Shigeo OTANI

Title: Chief Advisor/ Non-Revenue Management

Submission Date: March 26, 2021

I. Summary

1 Progress

1-1 Progress of Inputs

1-1-1 Japan Side

(1) List and Assignment Terms of Japanese Experts

a. Working in Rwanda

Table 1 Assignment Term in Rwanda (Phase 2) Working in Japan

	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2017/8/5	2017/10/16	2.43
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/9/18	1.50
			2018/10/20	2018/11/29	1.37
			2019/1/15	2019/3/9	1.80
			2019/4/15	2019/6/2	1.63
			2019/7/15	2019/11/24	4.43
			2020/1/21	2020/2/15	1.06
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2017/8/5	2017/9/17	1.47
			2018/5/24	2018/7/12	1.27
3	NRW Reduction Plan 1(1)	Chiaki SUZUKI/ Hiroyuki YAMAGUCHI Toru TOYODA	2017/8/5	2017/9/23	1.67
			2018/1/16	2018/3/1	1.50
			2018/5/9	2018/7/7	1.77
			2018/10/12	2018/12/27	2.57
4	NRW Reduction Plan 1(2)	Hiroyasu YODA	2017/11/8	2017/12/22	1.50
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/10/3	2.00
			2019/2/18	2019/4/6	1.60
5	NRW Reduction Plan 2(2)	Nobuyuki TSUTSUI	2017/8/5	2017/9/3	1.00
			2019/10/11	2019/11/30	1.70
			2021/3/6	2021/3/30	0.83
6	Leak Detection	Junichi TAKAHASHI	2017/12/3	2018/2/15	2.50
7	Pipe Repairing and Service Connection(1)	Tokiya MOMOZONO	2018/2/5	2018/4/5	2.00
8	ICT	Shigeo OTANI	2021/3/6	2021/3/30	0.83
Total MM					42.43

Note: Man Month (MM)

b. Working in Japan

Table 2 Assignment Term in Japan

No.	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2018/6/4	2018/6/8	0.25
			2019/6/24	2019/6/28	0.25
			20120/6	2020/12	5.75
5	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2019/9/13	2019/10/8	0.85
			2019/12	2020/12	7.95
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2017/8/1	2017/8/10	0.40
			2017/10/30	2017/11/9	0.40
	ICT	Shigeo OTANI	2020/4	2020/6	2.50
Total M/M					18.35

Details of each expert's assignment are shown in the Plan of Operation.

(2) List of Equipment Provided for the Project

Table 3 List of Equipment

Item	Output	Equipment	Description	Qty.	Procured by	Procurement Status	Handover Status	Date of Handover
1	2	E&M for training on pipe repairing and service connection	Pipes, piping materials and tools	1 set	KEC	Completed	Completed	2019/2/28
2		Leak detection equipment	Ultrasonic flow meter, leak detector, etc.	1 set	JICA	Completed	Completed	2019/2/28
3		Survey equipment	Portable GPS receiver, test meter, etc.	1 set	KEC	Completed	Completed	2019/2/28
4	3	Equipment for establishing Pilot DMA	Customer meters, mechanical flow meter, valves, etc.	1 set	KEC	Completed	Completed	2019/2/28
5		PRV piping materials	Pipe connectors for PRV installation	1 set	KEC	Completed	Completed	2019/2/28
6		Materials for service pipe replacement	PVC and deformed pipes	1 set	KEC	Completed	Completed	2019/2/28
7	1	Materials for distribution reservoir management	PRV 12sets, Float valves 10sets, pipes and piping material	1 Unit	KEC	Completed	Completed	2020/11/26
8		Materials for pressure control	Pipes and piping material for Bypass	1 Unit	KEC	Completed	Completed	2020/11/26
9		Portable test meters	DN15, 26sets	1 Unit	KEC	Completed	Completed	2020/5/21
10		Water Level Sensor and Datalogger	Water Level Sensor, Datalogger	3 sets	KEC	Completed	Completed	2020/11/26
11		Pressure sensor and Datalogger	Pressure sensor, Logger, Data Collector	3 sets	KEC	Completed	Completed	2020/11/26
12	Cov19 response activities	Engine Pump and Bulk Water Meter	Pump (DN80mm,55m3/hr, H20m) Meter (Waltman type, DN50mm, PN16)	23 sets	KEC	Completed	Noy yet	-
13		Procurement material for Reduction	Pipe and fittings for network repair	1 Unit	KEC	Not yet	Not yet	-

Item	Output	Equipment	Description	Qty.	Procured by	Procurement Status	Handover Status	Date of Handover
14		Intermittent Water	Service pipe	1 Unit	KEC	Not yet	Not yet	-
15			PRV、FV	1 Unit	KEC	Not yet	Not yet	-
16	4	Equipment for hydraulic isolation of 4 Branches and development of the monitoring systems	Flange Adapter、Dismantling joint.	1 Unit	JICA	Completed	Completed	-
17			Valve and pipes	1 Unit	JICA	Completed	Completed	-
18			Electro-magnetic flow meter, water pressure gauge, data logger,	1 Unit	JICA	Completed	Completed	-
			Server	1 Unit	JICA	Not yet	Not yet	
19			Monitoring systems (facility)	1 Unit	JICA	Not yet	Not yet	-
20	—	Equipment for project operation	Vehicle (minibus)	1 Unit	JICA	Completed	Not yet	-
			Vehicle (pickup)	1 Unit	JICA	Completed	Not yet	-
			Multifunctional photocopier	1 set	KEC	Completed	Not yet	-

Note: KEC (Kyowa Engineering Consultants c. co.jp)

(3) List of Facilities Provided for the Project

Table 4 List of Equipment

Facilities to be Provided

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Chambers for Pilot Areas	3 chambers for Pilot Area1 1 chamber for Pilot Area 2	set	1	Consultant	May. 2017, Sept, 2018 Completed	Completed
Lot 2	Chambers for Monitoring System		set	23	Consultant	Feb. 2019 Completed	Completed
Lot 3	Monitoring System		set	1	Consultant	In progress	Not yet

1-1-2 Rwanda Side

(1) Counterpart

Table 5 Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Celestin MWAMBUTSA	Head of water distribution services, WOS, UWSS
Output 3	Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

(2) Facilities

- Office space for Japanese experts at WASAC Head Office, office furniture
- Training room with the capacity of about 20 persons

- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

(3) Local Cost

- Cost for administering the Project (utilities for expert offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project for 2nd Phase

Start-up Meeting of the Project was held Aug. 9, 2017 with participation of members of Management Team and Action Team.

(2) Management Meeting (Joint Monitoring)

Table 6 Main items checked and actions taken in the joint monitoring

No.	Implementation period	Main items checked and actions taken	Changes to R/D, PDM, PO, etc.
Version 1	September 15, 2016	None in particular	None
Version 2	March 15, 2017	・ The activities of Output 1 (Activities 1.2 to 1.10) have been extended for about 3 months → To be completed by the end of August 2017 ・ The activities of Output 4 (Activity 4.3) has been extended due to the delay in procurement of equipment → Activities to continue in Phase 2	PO Version 1 →PO Version 2
Version 3	Aug 9, 2017	・Joint Monitoring Progress of each activity (preparation of 5YSP, Technical training, Pilot project, Isolation of 4 branches, Equipment procurement, others) ・Work Plan for Phase 2 Outputs ・Contents and implementation schedule of the Pilot Project	PO Version2 →PO Version3
Version 4	August 20, 2018	Progress of the Project Activities Achievements, issues and challenges Proposal of amendment of PO	Revision of RD, PDM, PO
Version 5	February 28, 2019	Progress of the Project Activities Achievements, issues and challenges Proposal for 4th year of the Project	
Version 6	May 20, 2019	Progress of the Project Activities Achievements, issues and challenges	Revision of PO
Version 7	November 19, 2019	Progress of the Project Activities Achievements, issues and challenges	Revision of PO
Version 8	March 23, 2021	Progress of the Project Activities Achievements, issues and challenges	Revision of PO

(3) Steering Committee (SC)

The results of holding SC meetings and future plans and agenda are as shown in the table below.

Table.7 The held time of the SC meeting and the agenda

Time	Holding time	Theme, contents
1st	April 3, 2017	・Discussion of the work plan (WP1), approval ・Confirmation of the Rwandan side burden matter
2nd	October 12, 2017	・Progress confirmation of the project ・Common knowledge of the NRW reduction 5YSP ・Approval of the second work plan ・About the enforcement of the project evaluation
3rd	August 28, 2018. At the time of Project Monitoring by JICA	・Result of Joint Monitoring ・ Procurement and Installation Plan of the Equipment for Monitoring System ・Monitoring result of the JICA Monitoring Survey Mission
4th	May 22, 2019	・ Progress of the Project ・ Rescheduling of Equipment Procurement and Installation of Output 4 ・ Additional Activities ・ Revised Work Plan for Phase 2
5th	February 4, 2020	・Progress and problems in the procurement and installation of equipment in the Output 4 activities ・Extension of the Project period ・ Progress of other project activities
6th	April 27, 2021	・Revision of the Plan of Operation after resumption of the work in Rwanda
7th	At the time of project completion, scheduled in Oct 2021	・Project evaluation

(4) Weekly Meeting

As a rule, PIM meetings are held basically at the end of every week and the activities for the week are reported, the activities scheduled for the following week are confirmed and pending issues, matters of concern, requests, etc., are discussed. The meetings are also utilized as a venue for training through seminars and workshops on matters proposed by the experts, etc. Meetings have been held 101 times as of the end of March 2021 (including thirty times in Phase 1).

(5) Project Progress Report (Part 6)

Project Progress Report (Part 6) was submitted to JICA and WASAC in January 2021.

1-2-2: Training in Japan and in the 3rd Country

(1) Training in Japan

Table 8 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5	- Introduction to water service management and NRW - Outline of water facilities in Yokohama and Kobe Cities and other matters
2	August 14 to 30, 2017	Business affairs and GIS matter	5	- Introduction to water service management and NRW - Customer information management, meter management and reading, and water service management - Examples of how local governments utilize GIS, purposes of use, and other matters
3	Nov. 13 to 30, 2017	Technical matter	5	Introduction to NRW, pressure management, leak detection, distribution management, and other matters

(2) Training in the 3rd country

Training in the 3rd country was conducted as shown in the table below.

Table 9 Training in the 3rd country

No	Country	Timing	Field of training	Trainees	Training Themes
1	Kenya	May 7 to 10, 2018	Management Team	2	An introduction and discussion of activity on NRW reduction carried out in Kenya (WASREB, MWI, KEWI, NYERI)
2	Malawi	Sept 22 to 27, 2019	Management and Action Teams	5	An introduction and discussion of activity on NRW reduction carried out in Malawi (LWB, EWASCO)

1-2-3: Activities of Output

【Activities of Output 1】： Planning capacity of NRW reduction of WASAC is enhanced.

1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.

Members of the Team were appointed in August 2016. Some change in September 2017.

1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

Questionnaire survey, site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems. These was done.

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

Discussion in a series of Workshops have been conducted. Framework of Action Plan was approved in the seminar on May 29, 2017.

1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

The implementation of the activities for identifying reservoirs that required urgent repair for overflow, one of the causes of water leakage, and repairing equipment in the facilities of the reservoirs, was proposed at the 4th SC. The functional survey of the 36 existing distribution reservoirs at the 26 sites in Kigali selected by the branch offices of WASAC was conducted in July and August 2019. The survey revealed that the distribution reservoirs at nine sites are in the greatest need of urgent repair. To prevent overflow from the identified reservoirs, float valves (FVs) were procured and installed in the reservoirs.

In the above-mentioned work, a discrepancy was found between the number of distribution reservoirs at 158 sites in Kigali in the GIS list of WASAC and the number of the existing reservoirs. It was also revealed that the reservoirs had not been named systematically and the structures and functional state of facilities of each reservoir were not known. In addition, the survey found overflow water leakage due to the absence or defect of FVs at many reservoirs. Based on these observations, it was decided to conduct an inventory survey to elucidate the functional state of the distribution reservoirs as an activity for Output 1. The results of the survey were to be used as the basic data for the implementation of 5YSP activities in the future.

The first survey of the distribution reservoirs was conducted between May and August 2020. The branch offices selected 55 reservoir sites where they found problems among the 158 sites in Kigali for the survey. Engineers were hired for the survey. The staff of the NRW Control Services, GIS Team, and branch offices of WASAC also participated in the survey. The same survey was conducted for the second time at 61 sites in September and October.

Based on the results of the surveys mentioned above, the list of the reservoirs in Kigali was updated. WASAC will create a database of the updated list for sharing and use the list as baseline data for the preparation of the plan for a 5YSP activity, functional improvement of the distribution reservoirs in Kigali. The reservoirs requiring the installation or replacement of FVs have been identified and the BOQ for the required equipment have been prepared.

The number of facilities to be surveyed is huge and the resources are limited. The priority was done to distribution reservoirs in Kigali and bulk meters assessment in almost all WTPs. As way forward, the survey method will be incorporated into NRW reduction manual. Dissemination will be done for all branches and WTPs in order to conduct the survey by themselves. Upcountry reservoirs survey and bulk meter assessment will be performed by WASAC.

1-5 Based on the results of Activity 1-3 and 1-4, management team prepares a draft of 5YSP.

The Final Draft of the 5YSP was completed in September 2017, and was approved at the 2nd SC which

was held on October 12, 2017.

1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

Although WASAC planned to reform its organizational structure with MININFRA's approval (March 2017), the reform plan has not been implemented.

WASAC reviewed its organizational structure again and the organizational gaps have been identified through the implementation of the 5YSP.It is necessary to consider organizational reform to promote the implementation of 5YSP. For example, the review WASAC structure to be more responsive and efficient. WASAC management recognized the importance of the organizational change and the re-structuring process is on-going.

1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP

A yearly implementation schedule for each specific action was prepared. As a future issue, it is necessary for each branch office to draw up individual detailed action plans, including construction of the facilities and procurement of the equipment (equipment for surveys and operation of water distribution system). Specific actions, which can be performed in 5YSP, were to be incorporated sequentially in the annual action plans of each branch for the time being.

1-8 WASAC secures budget in accordance with the priorities for the next fiscal year.

The NRW activity is being performed as a work activity within the normal budget (Utility Budget: current expenses, and OPEX: maintenance expenses) and there is need for budget implementation that is more specific to the activity items.

Therefore, the budget should be allocated to each branch for the implementation of branch-specific NRW reduction activities, however the budget has not been executed in accordance with the budgetary requests of the branches.

Insufficient annual budget doesn't not yet cover most of NRW reduction activities. CAPEX required for the NRW reduction seems to be huge compare to current available budget. WASAC should think about other sources of funds to support NRW reduction activities (OPEX and CAPEX).

1-9 The management team prepares the 5YSP that summarizes the achievements from Activities 1-1 to 1-7.

A management meeting attended by all DUWSS managers and all section heads was held on November 14, 2017, and the latest edition of the report was explained. The result was reported to the CEO and the Branch Managers the next day.

A report was submitted to the Senior Management Team by the project director Mr. Methode on

December 15, and the report was approved in the Senior Management Meeting held on February 12, 2018. 5YSP was finally officially approved by the WASAC Board of Directors on April 27, 2018. After responding to the comments received, the final approval of the WASAC Board of Directors was obtained on April 27. Implementation of the plan has been delayed by 1-year relative to the schedule, and will be commenced in fiscal year 2018/2019.

1-10 The management team holds seminars and presents 5YSP (Activity 1-8) for WASAC and other concerned parties.

5YSP was shared with the relevant persons in MININFRA and WASAC at the SC meeting on October 12, 2017.

The Project Manager and JICA expert had visited all WASAC branches between April and July 2018 and explained 5YSP to the staff members of the branches to make all of them understand it. The recording format for the monthly 5YSP activity report required for the explanation was finalized.

An in-house workshop was held in WASAC on July 19, 2018, to identify activities required for achieving the goal of the first year of the Non-Revenue Water Reduction 5YSP from the progress of and the problems found in the implementation of the plan.

1-11 The management team facilitates implementation and the monitoring of the 5YSP.

Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018.

Monitoring is carried out every quarter in accordance with the reports (monthly reports) from the branches. Monitoring started in July 2018. The contents of the reports are evaluated and a workshop on the reports is held every quarter.

The NRW Section, DUWSS, WASAC, prepared the quarterly monitoring report for fiscal year (FY) 2019/2020 4Q and submitted it to the Monitoring Team on September 25th, 2020. With the submission of the report, the activities in the second year of the project, FY 2019/2020, was completed. A workshop on the report was held on October 8th, 2020. The participants in the workshop evaluated the implemented NRW-reduction activities and discussed the ways to promote 5YSP in the future.

1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.

Initially, this activity was planned to be done by the Project. However due to the emergency to comply with RURA, this document was done by Commercial Directorate of WASAC (Connection Policy, Jan, 2019).

The reports on new connections in the 5YSP monthly reports confirmed whether the new connections had been established in accordance with the guidelines. But WASAC has not been able to provide

guidance on strict compliance with the guidelines. And, it was observed the need to revised again the new connection policy in order to ensure customers procured material are good quality. Because it has been confirmed that most of leaks are coming from service pipes (poor quality).

The gap between the policy and its implementation is still also a problem. As countermeasure, WASAC should review the new connection policy and the enforcement of its implementation.

1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

Insufficient budget allocation is a problem in the implementation of the NRW reduction activities.

1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

The finalized 5YSP report will be announced.

【Activities of Output 2】:

Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2-1 Training materials on NRW control are prepared.

Done.

2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.

Done.

2-3 OJT is conducted on the updating of GIS data, using available GIS data base.

Done.

2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

Done.

2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

Done.

2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

Done.

2-7 In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

Done.

2-8 Training materials on NRW are reviewed and updated.

The team has compiled the manual based on the various training materials used in the Output 2 activities and adding the methods of activities practiced in the Output 3 pilot project to those materials. The manual shall be used in the formulation of training programs.

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

The Directorate of Support Services (SSD) is responsible for the training programs in WASAC. The training programs in the Project should be incorporated into the training scheme of the entire WASAC to disseminate the NRW control technology to all staff members of WASAC. The cooperation between the NRW Control Services and SSD shall be strengthened for the technology dissemination.

The training is to be planned for the eleven subjects mentioned below that have been recognized as activities with high short-term effects in the Pilot Project and recognized as important subjects in the Pilot Project activities.

Table 10 Training Courses on NRW Reduction Activities

Item	Subject
1	Introduction to NRW Reduction Activities
2	High-Pressure Control
3	Water Distribution Control
4	Leakage Surveys and Repair
5	Replacement of Water Supply and Distribution Pipes
6	Management of Distribution Reservoirs
7	Control of Volume of Water Distribution
8	Maintenance of Charge Collection Data and Customer Meters
9	Monitoring of NRW Rates
10	Preparation for NRW Reduction Activities
11	Handling of Survey Equipment

The expected final result is that the training program formulated by this project will be incorporated into WASAC's human resource development plan, but it has not yet reached that stage despite completion of the manual. As countermeasure, finalize the manual validation and dissemination. Share the manual with

the HR in order to be incorporated into WASAC's internal training program.

【Activities of Output 3】

: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

3-1 The action teams are organized to conduct NRW reduction measures at Pilot Areas.

Member of the Team were appointed in August 2017.

3-2 The action team grasps the current situations of Pilot Area 1 and Pilot Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.

Done.

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Pilot Area 2.

Done.

3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1and 2.

Done.

3-5 The action team establishes the baseline NRW rate of Pilot Area 1 and Area2

Done.

Area1: Baseline: Mean value of June, July 2017. NRW Rate is: 37.3%
Area2: Baseline: Mean value of March, April 2018. NRW Rate is: 68.4%

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1 and Area 2.

Area1: The existing 327 customer meters were replaced with the new one by the result of on-site meter test (total surveyed 1,172).

Area2: General meter visual inspection for all customers 1,703 was conducted. In this, 135 were replaced by the result of on-site meter test.

3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness

Effect was evaluated on three comparisons cases of before and after replacement. 1) NRW rate, 1) Average

errors per meter, 3) Water Consumption volume.
The result of meter test shows that the effect of meter replacement was quite negligible.

3-8 The action team conducts measures for reducing surface leakage (visible leakage).

Area 1: In process as daily routine work of Branch office
Area2: Large quantity of the existing leakage was measured. Visible leakages were found at 16 places in March, 14 places in July and August.

3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

Done.

3-10 The action team conducts measures for reducing underground leakage (invisible leakage).

Area 1: Done.
Area2: Step test was conducted during May to July 2019.

3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

Area 1: Done
Aria 2: Qmnf measurement was conducted during June to September 2019.

3-12 The Action team conducts measures for reducing high water pressure.

Area 1: PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block. PRV at PM1 was set in September 2019.

Aria 2: Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept., one in RY2 in Oct., 2018. Additionally, one each in RY1 and RY3. Ball valve in RY1.

3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.

Area 1: The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.

Aria 2: The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. NRW rate before and after PRV adjustment was compared in A2 (Small DMA). Also, Qmnf before and after setting PRV was compared. Qmnf was measured.

Planned pilot activities in the pilot area were completed, although some equipment (Bulk meter, 2PRVs)

was defected. The replacement took time because of limited maintenance budget from the Project and WASAC.

For the sustainability of NRW reduction it should be continued to monitor the Pilot area (reading index, calculation of the NRW, progress). WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities using lesson learned from the Project.

3-14 Cost-benefit Analysis of NRW Reduction Measures

As the NRW ratio in Pilot Area 1 had reached the target value in January, February and March 2019, the cost benefit analysis of the NRW reduction activities in the area was implemented in April 2019 to elucidate the effectiveness of the project. The achievement target for Area 2 is high. As the water supplied from the Nzove Pumping Station was distributed directly through a pipeline that bypassed a distribution reservoir (bypass pipeline) in this area, the water distribution pressure was high. This high pressure was a major cause of water leakage. Although the pressure control in the night and the pressure adjustment in areas with large existing leakage had been implemented, these measures failed to produce the expected NRW reduction.

Although the NRW reduction achieved by these measures was limited, the cost-benefit analysis of these measures proved that they had an NRW reduction effect.

- The calculation of the NPV and B/C values clearly shows the effect of the NRW reduction activities (NPV>0 and B/C>1) in each case, while the values varied from year to year.

In conclusion, the investment in NRW reduction activities had sufficient effect when the activities reduced the NRW rate to a certain degree (by approx. 10 %) even if the rate was very high like in Ruyenzi (68 %). Therefore, it is important to actively promote cost-effective activities, such as the reduction of high-water pressure (installation of PRVs) in the pipes, surveys and repair of water leakage (underground water leakage, in particular), and replacement of water supply and distribution pipes.

In Pilot areas (Ruyenzi), the target value (25%) could not be achieved, due to poor quality water pipes and high pressure.

As countermeasure, it is necessary to continue NRW reduction activities in this Pilot Area. Replacement of small-diameter HDPE pipes which has high leakage is being conducted in the framework of JICA COVID-19 support. Preparation of BoQ for tender of material procurement is in process.

3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.

The JICA Expert Team has completed the preparation of the completion report and explained and submitted it to WASAC.

Pilot Area 1 : Submitted to WASAC in October 2019
Pilot Area 2 : Submitted to WASAC in January 2020

WASAC is studying the report and preparing comments on it. The comments of WASAC shall be incorporated in the completion report and the knowledge acquired and lessons learned from the pilot project activities shall be reflected in the 5YSP.

3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.

The action team invited the heads of Kacyiru and Nyarugenge Branches that were responsible for the water services in Pilot Areas 1 and 2, respectively, to a seminar held on February 14, 2020.

When the completion report has been finalized after the second review by the C/P, the action team shall hold a workshop on the report for all WASAC staff.

3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

It was decided to set up the manual preparation team of the pilot project inside WASAC and prepare the manuals in coordination with this team. The manual preparation meetings were regularly held after the kickoff meeting held on January 29th, 2019.

The Pilot Project Completion Report and the NRW-reduction Manual have already been prepared. WASAC shall hold an in-house workshop to disseminate the report and manual in WASAC.

【Activities of Output 4】:

4 branches in Kigali establish the system to measure NRW rates accurately.

4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

Done.

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

Done.

4-3 Chambers are constructed as appropriate.

Done.

4.4 Electromagnetic flow meters and pressure gauges to be procured and installed

JICA will be responsible for the procurement and installation of the monitoring equipment. JICA will

employ a contractor for the procurement and installation. In accordance with the original plan of holding the tender for the procurement and installation of the equipment in Kigali, JICA announced the invitation to the tender on May 26, 2017. The tender failed in October 2017 after all bidders had been disqualified because their financial states and/or the technical specifications of the equipment in their bid proposals did not meet the tender requirements. Therefore, JICA decided to hold another tender for a blanket contract including the installation work at its headquarters.

Tenders were submitted on July 23, 2019, and the contract with Takaoka Engineering Co., Ltd. was concluded on September 20. Takaoka Engineering conducted a site survey. The kickoff meeting and a wrap-up meeting were held in September 2019.

However, subsequently the Project was suspended since March 2020 until March 2021 because of the prevention against COVID-19 pandemic. The construction was resumed in march 2021 when Japanese engineers were able to supervise it on-site.

Activity has been delayed due to Covid-19 restriction measures, but equipment procurement has been almost completed and the installation work has been commenced. The remaining works are to complete following tasks:

- To complete the transfer of customer registrations as the branch-to-branch boundary is moved.
- To replace default meters installed in SUSWAS project at an early time.
- To train WASAC team to properly operate the installed NRW monitoring system

4.5 System input to each of 4 branches to be measured

After construction of the monitoring system, measurement data on the quantity of water distributed to each branch within Kigali City (input water quantity) will be continuously collected in day units. The data will be accumulated on a server in the central server room. Using this data, the NRW percentage of each branch will be calculated. The calculation of the NRW percentage will be carried out in Excel file format. The NRW percentages obtained will be used as indexes for non-revenue water reduction activities in each branch, so they will be used for reviewing the 5YSP.

A draft version of the NRW percentage calculation software has already been prepared. On November 1, 18 and 26, 2019 meetings were held for key persons in UWSS, which is the main department that will use the software, and other departments involved in maintenance. Details of the calculation software, method of use, and training schedule were explained, and their understanding was obtained. Improvements will be made with respect to requests for ease-of-use from the WASAC side, and the software will be completed before commencement of training (OJT) of WASAC staff.

4.6 Based on the results of Activity 4-5, NRW rates for each branch to be calculated and reported

On-the-job training (OJT) for the NRW percentage calculation software is scheduled to be implemented

over 3 months after construction of the system.

1-3 Achievement of Output

(1) Output1 Planning capacity of NRW reduction of WASAC is enhanced.

Indicator 1-1: ５YSP is reviewed and updated, taking into account of the results of the Pilot Project.

The Project updated or added/modified some indicators in the 5YSP after reviewing the monitoring results of the pilot project.

The Project held a review workshop inviting primary members including managers to look back and update the 5YSP in July 2019. The participants evaluated the achievements of the pilot project according to monitoring indicators as well as discussed necessary additional further actions. The workshop concluded some updates of implementation and monitoring plans with new indicators.

Primary indicators updated/added are as follows:

- Number of PRV installed
- Number of customer meters replaced
- Number of customer inspections conducted
- Number of customer meters inspected their accuracy

WASAC plans to review and update the plan continuously with official approval of the WASAC's board.

Indicator 1-2: All the project achievements are shared by WASAC and other concerned parties by holding seminars.

- Sharing information within WASAC:

All the progresses and challenges the Project encountered are being shared though various workshops, seminars, management meetings, and SC meetings.

- Sharing information with concerned parties:

MINIFRA as a major stakeholder has participated in SC meetings. Information and lessons of the Project have been well shared.

The Project will hold a final seminar to present all the achievements of the Project by the end of the Project period.

Overall assessment:

The Project has achieved the Output 1 as of the Terminal evaluation.
It can be evaluated that the cycle of Plan-Do-Check-Action, PDCA cycle, has been well applied in WASAC's job place.

(2) Output2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.

Indicator 2-1: More than 300 number of trainees receive training.

The Project has conducted many types of trainings. The total number of trainees counted to 596 as of the Terminal evaluation.

Indicator 2-2: WASAC human resource development plan includes training programs prepared by the project.

The Support Service Department, SSD, is in charge of training plan and implementation in WASAC in accordance with the human resource development plan. The training program widely covers various technical topics, inviting internal trainers as well as external trainers from other organizations.

The outputs of the Project, training program on NRW reduction, will be a part of entire training program of WASAC. Discussion between the NRW unit and the SSD is about to start after finalization of technical manuals as training texts, which are now at the last stage of checking the contents.

Overall Assessment:

The Project has almost achieved the Output 2 as of the Terminal evaluation.
As of the Terminal evaluation, although training programs prepared by the Project has not been materialized yet in the entire training programs of WASAC, it is highly possible to be done by the end of the Project.

(3) Output3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

Indicator 3-1: NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.

Result of NRW rate were not to reach the target figures.

Pilot Area 1: 25% (2019/20)
Pilot Area 2: 56% (2019/20)

<u>Pilot Area 1:</u>

Maintaining the installed facilities is quite important to keep and/or reduce the NRW ratio especially

after the implementation of NRW reduction activities with equipment installation, however PRV at the PM 2 and 3 have had mechanical problems since June 2019, then water pressure has not been controlled as expected. Only PRV at the Sub-Block 1 has been functioning well. This is considered as a part of reasons of the current status.

Pilot Area 2:

PRV has been contributing to NRW reduction up to the certain level; however, it is difficult to reach the target figure. Considering the geographical condition of the target area, following measures are additionally required; 1) necessary to conduct pressure control more segmentally by altitude basis; and 2) necessary to reinstall water service pipes and to redesign water distribution network.

This nonattainment situation should be also analyzed from the viewpoint of the level set as the target figures. Firstly, the Project set the target figures at rather challenging level. Secondly, NRW rate reduction can be attained by not only excellent manpower but also material inputs including infrastructure and equipment. NRW reduction requires approaches from both sides. Moreover, thirdly, the target area is located at quite challenging geographical condition for NRW reduction with huge difference of elevation. Considering such feature of NRW reduction at this target area, the Project has faced difficulties in terms of reaching the target figure.

Indicator 3-2: Action team members share experiences at workshops regarding implementation of the pilot projects.

In the same manner as the indicator 1-2, the Action team members shared experiences and lessons through workshops and a variety of meetings.

Indicator 3-3: The action team prepares a completion report of the pilot project.

The draft completion reports of the pilot project were already presented to WASAC from the JICA experts in October 2019 for the Pilot Area 1 and in February 2020 for the Pilot Area 2. WASAC will review and finalize them through workshops.

Overall Assessment:

The Project has almost achieved the Output 3 as of the Terminal evaluation.

The aim of this Output is to enhance capacity to cope with expected and unexpected events at working fields, employing the technical knowledge and skills obtained in the Output 2.

Through implementation of the pilot project, WASAC developed their technical capacity on NRW reduction. Actual experiences at working fields directly contributed to enhancing their technical proficiency. Followings are the major technical items which the counterparts enhanced: formulation of

DMA; conducting tests of customer meters, planning and conducting leak detection survey including step test and Qmin measurement; management and control water pressure; planning of replacement of aged and substandard pipe, making customer mapping.

In addition, the cost benefit analysis of countermeasures to NRW reduction was conducted in the framework of this Output, and concluded their countermeasures economically viable.

Overall, although one of the key indicators, reduction of NRW rates, have not been fulfilled yet, the essential goal of this Output, which is to enhance technical capacity to cope with actual working field and identify the major cause of NRW and each countermeasure has been developing as expected. The Output 3 can be evaluated “almost achieved” in this context.

(4) Output4　4 branches in Kigali establish the system to measure NRW rates accurately.

Indicator: NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.

The system to measure NRW rate has not been installed yet due to delay in equipment procurement. As of the Terminal evaluation, although a part of equipment has already arrived at Rwanda, their installation works have been suspended under COVID-19 situation.

Overall assessment:

The Project has not achieved the Output 4 yet as of the Terminal evaluation.

The system to measure NRW rate has not been installed yet due to delay in equipment procurement and influence of COVID-19 situation. OJT for NRW rate calculation and reporting by using data obtained from monitoring system is also planned after the equipment installation.

Besides, it should be noted that the Project’s system plans to be operated together with monitoring network of SUSWAS project. However, the system by SUSWAS is currently out of order. In order for the Project’s system to function completely, repairing works of SUSWAS system by WASAC is indispensable.

In addition, re-registration of customers whose residential location lie in boarder area of the targeted branches should be completed.

1-4 Achievement of the Project Purpose

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.

Indicator 1: 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.

The 5YSP for NRW reduction was approved on the 27th April, 2018 by the Board meeting of WASAC where a representative of MINIFRA also attended.

Indicator 2: Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC

Each branch has annual action plan for NRW reduction which shows necessary actions such as PRV installation, meter replacement, leakage survey, and others. Their plans comprise a part of the annual action plan of entire WASAC.

Indicator 3: The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction

The indicator 3 has not been achieved, or in other words, the achievement status is moderate at this moment. This indicator contains two different issues, firstly, recognition of the effects of NRW reduction by WASAC management strata, and secondly, budget approvement.

The management strata of WASAC fully recognized the effectiveness of NRW reduction measures through the pilot project and already extended the same countermeasures such as installation of PRV and float valve, FV, balk meter assessment, customer analysis, customer inspection, on site meter testing, customer meter replacement outside of the pilot project area.

On the other hand, budget allocation for branches on NRW reduction has been facing immense challenges. In the case of the year 2019/20, although WASAC headquarter approved annual action plans, the actually allocated budget for NRW reduction works was lower than the planned budget. The difference created discrepancy between the plan and the actual activities.

Overall assessment:

The Project purpose has been almost achieved.

Towards the Project purpose "enhancement of WASAC's capacity to conduct NRW reduction measures", the Project took approaches from four (4) aspects, 1) planning aspect, 2) technical aspect, 3) applied technical aspect, and 4) establishment of NRW rate measuring system. As the achievement status of the Output 1 shows, WASAC has been steadily implementing and monitoring NRW works in accordance with the 5 YSP by PDCA cycle. In 2) technical aspect, WASAC's staffs acquired knowledge and skills through a series of trainings in the Output 2. Capacity to cope with actual situations/challenges at working field is also enhanced through the pilot project, as 3) applied technical capacity, the Output 3. Only 4) as the Output 4: establishment of NRW rate measuring system is still remained.

On the other hand, looking at fulfillment status of the indicators, it has to be pointed out that actual budget allocation is not matched with annual action plan. Since WASAC itself cannot increase its

organization's revenue without raising water tariff as an independent corporation status, this insufficient situation is not attributed to WASAC; however, this deviation of NRW action plan is strongly influential on WASAC's NRW reduction efforts on the basis of the acquired technical skills by the Project.

In conclusion, although the Project has challenges on budgetary aspects, the Project activities successfully led to capacity enhancement of WASAC. Subtracting the indicators' moderate achievement status, the Project purpose is evaluated "almost achieved".

1-5 Achievement of Overall Goal

WASAC conducts NRW reduction measures as planned for Kigali city.

Indicator: NRW rate of Kigali city (year 2022/23 : 25 %)

Achievement status of the Project outputs is observed according to the PDM indicators. Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017 (40.3 % on the average of 2019/20)

It is highly prospected that WASAC continues to apply NRW countermeasures, which enables to reduce the NRW rate step by step; though, it may take more time until reaching the indicator's level than the target year.

Lessons from the pilot project successfully specified prioritized countermeasures including 1) water pressure management, 2) distributing reservoir management, 3) replacement of aged and substandard pipes, 4) quick and quality pipe repair, 5) water billing data management, and 6) customer meter management.

However, immense budget is required if all of them take in place especially 1) water pressure management and 3) replacement of aged and substandard pipes. Therefore, achievement of the Overall goal is heavily dependent on securement of budget of WASAC from now on.

1-6 Changes of Risks and Actions for Mitigation

Due to covid-19 infection prevention measures, JICA has banned business travel from March 2020. It resumed in March 2021, but for this one year, it has been working remotely using the Internet with counter parts and with local staff, but the decrease in efficiency cannot be denied. In particular, we were forced to stop the procurement and installation of equipment for the Output4 monitoring system.

1-7 Progress of Actions undertaken by JICA

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment was procured in July 2017.

- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is behind the schedule.

1-8 Progress of Actions undertaken by Rwanda side

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Preparation of 5YSP for NRW reduction.
- Joint visit JICA-WASAC of WASAC's upcountry branches.
- Training in Japan
- Training in the third Country

1-9 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

None

2. Delay of Work Schedule and/or Problems

In view of the delay of the Project caused by COVID-19, it was decided to extend the project to December 2021 in December 2020.

II. Project Monitoring Sheet I & II

As attached.

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 8

Dated March 26, 2021

Implementing Agency: WASAC

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2021/12/31

Project Site: 6 Branches in Kigali city（Kacyiru, Nyamirambo, Gikondo, Nyarugenge, Remera and Kanombe ）

Model Site:

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement
Overall Goal				
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city （year 2022/23 : 25 %)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25%. Achievement in 2020/2021 was 40.3%. NRW rate 15.3% has to be reduced to achieved the target. It is a challenge to reach the target figure by the time of the goal setting 2022/2023. Achievement of the Overall goal is heavily dependent on securement of budget of WASAC.
Project Purpose				
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure	The non-revenue water section at WASAC is not subject to large scale reorganization.	5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.
	2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC	2 Annual action plan of WASAC	WASAC staff do not resign after training by the Project.	The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area. Though in the future more specific actions for NRW reduction is needed. NRW reduction Branches annual budgets should be incorporated in the company NRW reduction budget.
	3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	3 Budget of WASAC	Large scale natural disaster dose not occur.	The budget of NRW reduction activity was decided in WASAC Action Plan. On the other hand, that budget is not fully allocated at an implementation level for branches on NRW reduction. In the case of the year 2019/20, although WASAC headquarter approved annual action plans, the actually allocated budget for NRW reduction works was lower than the planned budget. The difference created discrepancy between the plan and the actual activities.
Outputs				
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project.	1-1 Records of the project		5YSP is being updated considering the result of it's implementation for past 2 years, findings from the pilot project and observation from the MP studies. The final draft of the revised version is expected in the beginning of May and will follow the normal approval process.
	1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-2 Records of the project		All the progresses and challenges the Project encountered are being shared though various workshops, seminars, project management meetings, and SC meetings. MININFLA as a major stakeholder has participated in SC meetings. Information and lessons of the Project have been shared. The Project will hold a final seminar to present all the achievements of the Project by the end of the Project period.
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training.	2-1 Records of the project		596 cumulative number of trainees were received training (60 numbers of the staff).
	2-2 WASAC human resource development plan includes training programs prepared by the project.	2-2 Records of the project		The manual containing training courses is ready and in validation process by the technical and commercial directorate. Finalize the manual validation and dissemination and share the manual with HR in order to be in cooperated into WASAC's internal training program.
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.	3-1 Records of the project		Result of NRW rate were not to reach the target figures. Q3 of 2019/2020 (in March 2020) Pilot Area 1: 25% Pilot Area 2: 56%
	3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.	3-2 Records of the project		In the same manner as the indicator 1-2, the Action team members share experiences and lessons through workshops and a variety of meetings.
	3-3 The action team prepares a completion report of the pilot project.	3-3 Survey plans for locations outside the pilot project		The draft completion reports of the pilot project were already presented to WASAC from the JICA experts in October 2019 for the Pilot Area 1 and in February 2020 for the Pilot Area 2. WASAC will review and finalize them through workshops
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		The system to measure NRW rate has not been installed yet due to delay in equipment procurement. Though equipment procurement and their installation works have been suspended under COVID-19 situation, the works resumed from February 2021. In order for the Project's system to function completely, repairing works of SUSWAS system by WASAC is indispensable, also re-registration works of customers whose residential location lie in boarder area of the targeted branches. OJT for NRW rate calculation and reporting by using data obtained from monitoring system is also planned after the equipment installation.

Activities	Inputs		Pre-Conditions
	The Japanese Side	The Rwanda Side	
1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.			
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser／Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.	GIS	Management team members	
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	GIS data should continue to be updated
1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Leak detection	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	2 Training		
1-11 The management team facilitates implementation and the monitoring of the 5YSP.	Training in Japan		
1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	Training in the 3rd country		
1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.		2 Facilities	
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.		Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-1 Training materials on NRW control are prepared.	3 Equipment provision	Training room with the capacity of about 20 persons	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.	Equipment for training on pipe repair and service pipe connection	Space for training on pipe repair and service pipe connection（40㎡）	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	Gate valve, flow meter, and customer meter for Pilot Project	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Leak detection equipment		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Equipment for survey (Mobile GPS etc.)	3 Local cost	
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Pipes and related fittings for service pipe replacement in Kadobogo	Cost for administering the Project (utilities for experts offices, internet services)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	PRV fittings in pilot area	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8 Training materials on NRW are reviewed and updated.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Vehicles and photocopy for Japanese experts	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	PRVs and Float Valves for Additional Activities		
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Potable Test Meter additionally procured (26 sets)		
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.			
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	4 Facility provision		
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.	Flow-meter Chambers (4) for Pilot areas		
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Flow-meter Chambers (23) for Equipment Monitoring System		
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	PRV Chambers: Kadobogo (1), Ruyenzi (5), Additional for outside pilot area (12)		
3-8 The action team conducts measures for reducing surface leakage (visible leakage).			
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12 The action team conducts measures for reducing high water pressure.			
3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			
3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.			
3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.			
3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.			
3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.			
4-4 Chambers are constructed as appropriate.			

4-5	System input to each of 4 branches is measured.			
4-6	Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 8
Dated March 26, 2021

Project Title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs	Plan / Actual	1st Year (16/17)	2nd Year (17/18)	3rd Year (18/19)	4th Year (19/20)	5th Year (20/21)	6th Year (21/22)	Remarks		
		I II III IV	I II III IV	I II III IV	I II III IV	I II III IV	I II			
Expert										
Chief Adviser/Non-Revenue Water Management (Otani)	Plan									
	Actual									
Adviser/Non-Revenue Water Management (Higuchi)	Plan									
	Actual									
NRW Reduction Plan 1(1)(Suzuki/Yamaguchi/Toyoda)	Plan									
	Actual									
NRW Reduction Plan 1(2)(Yoda)	Plan									
	Actual									
NRW Reduction Plan 2(1)(Toyoda)	Plan									
	Actual									
NRW Reduction Plan 2(2)(Tsutsui)	Plan									
	Actual									
Geographic Information System: GIS (Horishita)	Plan									
	Actual									
Hydraulic Analysis (Ooe)	Plan									
	Actual									
Leak Detection (Takahashi)	Plan									
	Actual									
Pipe Repairing and Service Connection (1) (Momozono)	Plan									
	Actual									
Pipe Repairing and Service Connection (2) (Takashima)	Plan									
	Actual									
Information and Communication Technology: ICT (Brouwer)	Plan									
	Actual									
Long Term Expert (Mayusumi)	Plan									
	Actual									
Equipment								Handed Over		
Lot 1: Equipment for training on pipe repair and service pipe connection	Plan							Feb. 28, 2019		
	Actual									
Lot 2: Pilot Projects (Gate valve, flow meter, and customer meter)	Plan							Feb. 28, 2019		
	Actual									
Lot 3: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.)	Plan							Feb. 28, 2019		
	Actual									
Lot 4: Equipment for survey (Mobile GPS, Potable Test meter etc.)	Plan							Feb. 28, 2019		
	Actual									
Lot 5: Pipe and related fittings for service pipe replacement in Kadobogo	Plan							Feb. 28, 2019		
	Actual									
Lot 6: PRV fittings in Pilot area	Plan							Feb. 28, 2019		
	Actual									
Lot 7: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)	Plan							Procurement is in process	This will be handed over at the completion of the monitoring system	
	Actual									
Lot 8: Vehicles and photocopy for Japanese experts	Plan							Using in project activities	This will be handed over at the end of the Project	
	Actual									
Lot 9: PRVs and Float Valves for Additional Activities	Plan							Nov. 26, 2020		
	Actual									
Lot 10: Potable Test Meter additionally procured (26 sets)	Plan							21-May-20		
	Actual									
Training in Japan										
15 persons will be trained in Japan (5, 5, 5)	Plan							Done		
	Actual									
In-country/Third country Training										
2 persons will be trained in Kenya	Plan							Done		
	Actual									

Activities		Plan / Actual	1st Year (16/17)	2nd Year (17/18)	3rd Year (18/19)	4th Year (19/20)	4th Year (19/20)	6th Year (21/22)	Achievements	Issue	Countermeasures
	Sub-Activities		I II III IV	I II III IV	I II III IV	I II III IV	I II III IV	I II			
Output 1: Planning capacity of NRW reduction of WASAC is											
1.1	A management team is organized to prepare 5YSP for NRW reduction.	Plan							Members of the Team were appointed in August 2016. Some change in September 2017.	None	None
		Actual									
1.2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and outside Kigali city (14 branches), and identifies problems.	Plan							Questionnare survey, Site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems.	None	None
		Actual									
1.3	Based on the problems identified, the management team proposes NRW reduction measures by WASAC in the future.	Plan							Discussion in a series of Workshops. Framework of Action Plan was approved in the seminar on May 29, 2017	None	None
		Actual									
1.4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan							Inventory survey was done for all Kigali distribution reservoirs and the bulk meter survey was done for all most all WTPS.	The number of facilities to be surveyed is huge and the resources are limited.	The priority was done to distribution reservoirs in Kigali and bulk meters assessment in almost all WTPs. As way forward, the survey method will be incorporated into NRW reduction manual. Dissemination will be done for all branches and WTPs in order to conduct the survey by themselves. Upcountry reservoirs survey and bulk meter assessment will be performed by WASAC.
		Actual									
1.5	Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP	Plan							Draft Final report of 5YSP was approved at the second SC on Oct. 12, 2017	None	None
		Actual									
1.6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan							The organizational gaps have been identified through the implementation of the 5YSP.	It is necessary to consider organizational reform to promote the implementation of 5YSP. For example, the review WASAC structure to be more responsive and efficient.	WASAC management recognized the importance of the organizational change and the re-structuring process is on-going.
		Actual									
1.7	The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Plan							A yearly implementation schedule for each specific actions and its priority were prepared.	None	None
		Actual									
1.8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan							Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX) NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. Some activities align with 5YSP implementation are also being considered. Budget for CAPEX are being considered in the revised 5YSP.	Insufficient annual budget doesn't not yet cover most of NRW reduction activities. CAPEX required for the NRW reduction seems to be huge compare to current available budget.	WASAC should think about other sources of funds to support NRW reduction activities (OPEX and CAPEX).
		Actual									
1.9	The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan							5YSP was officially approved by the Board of Directors on April 27, 2018.	None	None
		Actual									
1.10	The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan							5YSP was shared at the SC on October 12, 2017. Approved 5YSP by both management and BoD. Explained at each Branch from April to July 2018.	None	None
		Actual									
1.11	The management team facilitates implementation and the monitoring of the 5YSP.	Plan							Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018. Monitoring has being conducted from 2018/19 at every Q by monthly report.	None	None
		Actual									
1.12	The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	Plan							The New Connection Policy was formulated in January 2019 as a revised version of the Requirements for Water Distribution and House Connection due to the emergency to comply with the regulatory agency (RURA).	Later, it was observed the need to revised again the new connection policy in order to ensure customers procured material are good quality. Because it have been confirmed that most of leaks are coming from service pipes (poor quality). The gap between the policy and its implementation is still also a problem.	WASAC should review the new connection policy and the enforcement of its implementation.
		Actual									
1.13	The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan							Budget of WASAC Action Plane was approved.	Budget is not sufficient for implementation for all activities of 5YSP.	Same as 1.8
		Actual									
1.14	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Plan							Not yet	None	Hold seminars
		Actual									
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.									Achievements	Issue	Countermeasures
2.1	Training materials on NRW control are prepared.	Plan							Done	None	None
		Actual									
2.2	Training on NRW management is conducted for the management team and WASAC management as necessary.	Plan							Done Each training item has been implemented by April 2018.	Capacity Assessment of the new knowledge acquired through training has not yet been conducted	This will be done after the completion of the pilot project.
		Actual									
2.3	OJT is conducted on the updating of GIS data, using available GIS data base.	Plan									
		Actual									
2.4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan									
		Actual									
2.5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan									
		Actual									
2.6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Plan									
		Actual									
2.7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan									
		Actual									
2.8	Training materials on NRW are reviewed and updated.	Plan							In two pilot projects, activities were carried out to further master the skills obtained through the training. In addition, based on the training materials used in the activity of Output 2, a NRW reduction manual was created by adding the method of activities practiced in the pilot project.	None	None
		Actual									
2.9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan							The manual containing training course is ready and in validation process by the technical and commercial directorate.	The expected final result is that the training program formulated by this project will be incorporated into WASAC's human resource development plan, but it has not yet reached that stage despite completion of the manual.	Finalize the manual validation and dissemination. Share the manual with the HR in order to be incorporated into WASAC's internal training program.
		Actual									

Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

			Achievements	Issue	Countermeasures
A. Preparation					
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Plan / Actual	Member of the Team were appointed in August 2017	None	None
3.2	The action team grasps the current situations of Pilot Areas through reviewing available maps, customer ledgers, surveys, and other necessary means.	Plan / Actual	Done	None	None
3.3	The action team plans and schedules the implementation of the pilot project.	Plan / Actual	Done	None	None
3.4	The action team hydraulically isolates Pilot Areas, and installs flow meters and pressure gauges at the inlets of the Areas.	Plan / Actual (Procurement of Equipment and Construction of Chamber)	Flow meters and pressure gauges were installed in the meter chambers by May 2017.	None	None
B. Activity of Pilot Area 1 Kadobogo					
3.5	The action team establishes the baseline NRW rate of Pilot Area.	Plan / Actual	Baseline: Mean value of June, July 2017 NRW Rate is: 37.3%	None	None
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA).	Plan / Actual	The existing 327 customer meters were replaced with the new one by the result of on-site meter test (total surveyed 1,172).	None	None
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	Effect was evaluated on three comparisons cases of before and after replacement. 1. Total meter error , 2. Consumption volume of replaced meters.	None	None
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan / Actual	Done	None	None
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual	Done	None	None
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan / Actual	Done	Some leak detection equipment not appropriate for the majority of the existing water network condition (lack of some facilities such as valves, etc.)	Use those equipment efficiently where they can be applied more training on sophisticated one.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual	Done	None	None
3.12	The action team conducts activities for reducing high water pressure.	Plan / Actual	PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block. PRV at PM1 was set in September 2019.	PRV of PM3 lost function from May 2019. So the NRW rate of PM3 increased rapidly. The importance of maintenance after PRV installation was recognized. It is necessary to periodically check the pressure setting value of the PRV. The PRV was newly replaced in 2020**.	None
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan / Actual	The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.	Planned pilot activities in the pilot area were completed, although some equipment's (Bulk meter , 2 PRVs) were defected. The replacement took time because of limited maintenance budget from the project and WASAC.	For the sustainability of NRW reduction, it should be continued to monitor the Pilot area (reading index, calculation of the NRW, progress). WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities using lesson learned from the Project.
C. Activity of Pilot Area 2 Ruyenzi					
3.5	The action team establishes the baseline NRW rate.	Plan / Actual	Baseline: Mean value of March, April 2018 Original: 68.4%	None	None
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) .	Plan / Actual	General meter visual inspection for all customers 1,703 was conducted. In this, 135 were replaced by the result of on-site meter test.	None	None
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual	The result of meter test shows that the effect of meter replacement was minus but quite negligible.	None	None
3.8	The action team conducts activities for reducing surface leakage (visible leakage).	Plan / Actual	Large quantity of the existing leakage was measured. Visible leakages were found at 16 places in March, 14 places in July and August.	None	None
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual	Done	None	None
3.10	The action team conducts activity for reducing underground leakage (invisible leakage).	Plan / Actual	Step test was conducted during may to July 2019.	Invisible leakage could not be found because of complexity of the existing network.	Pressure reduction was required for control of underground leakage.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual	Qmnf measurement was conducted during June to September 2019.	The result shows that most critical area of leakage is high pressure area by bypass of the Ruyezi reservoir.	Pressure reduction was required for control of underground leakage.
3.12	The action team conducts measures for reducing high water pressure	Plan / Actual	Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept. , one in RY2 in Oct., 2018. Additionally, one each in RY1 and RY3. Ball valve in RY1.	None	None
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan / Actual	The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.	Planned pilot activities in the pilot area were completed, although some equipment's (Bulk meter , 2 PRVs) were defected. The replacement took time because of limited maintenance budget from the project and WASAC.	For the sustainability of NRW reduction, it should be continued to monitor the Pilot area (reading index, calculation of the NRW, progress). WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities using lesson learned from the Project.
D. Report, Manual and Seminar					
3.14	The team reviews the results of Activities, and undertakes cost-benefit analysis of NRW for each Activity.	Plan / Actual	The cost-benefit analysis was done based on the NRW rate measured until January 2020. The calculation of the NPV and B/C values clearly shows the effect of NRW reduction activities. In conclusion, the investment in NRW reduction activities had sufficiently effect when the activities reduced the NRW rate to a certain degree (by approx. 10%) even if the rate was very high like a Ruyenzi (68%).	In Pilot areas (Ruyenzi), the target value (25%) could not be achieved, due to poor quality water pipes and high pressure.	It is necessary to continue NRW reduction activities in this Pilot Area. Replacement of small-diameter HDPE pipes which has high leakage is being conducted in the framework of JICA COVID-19 support. Preparation of BoQ for tender of material procurement is in process.
3.15	The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project, and submits it to the management team.	Plan / Actual	Draft of completion report was completed in October for Pilot1 and February, 2020 for Pilot 2.	None	None
3.16	The action team holds a workshop and presents the completion report of the pilot project prepared to WASAC.	Plan / Actual	Not yet	None	Hold seminars
3.18	Action team prepares manuals on methods and use of survey equipment learned from the pilot project, and holds seminars in order to share them with WASAC.	Plan / Actual	Same as 2.8	same as 2.8	Same as 2.8
3.19	Action team disseminates the manual and use of survey equipment to the activity of whole branches.	Plan / Actual	Not yet	None	None

Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.

			Achievements	Issue	Countermeasures
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan / Actual	Done	None	None
4.2	Based on the isolation plan, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan / Actual	Done	None	None
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.	Plan / Actual	The equipment procurement has been almost completed and the installation was commenced at middle of April.	Delay due to Covid-19 reduction measures.	The remaining works are to complete following tasks: To complete the transfer of customer registrations as the branch-to-branch boundary is moved. To replace default meters installed in SUSWAS project at an early time. To train WASAC team to properly operate the installed NRW monitoring system.
4.4	Chambers are constructed as appropriate.		23 meter chambers have been constructed	None	None
4.5	System input to each of 4 branches is measured.	Plan / Actual	This work will carry out after completion of the monitoring system (installation of flow meters)	delay of completion of the monitoring system	same as 4.4
4.6	Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.	Plan / Actual	Ditto	Ditto	Ditto

Duration / Phasing — Plan / Actual

Monitoring Plan — Plan / Actual

1st Year (16/17): I, II, III, IV | 2nd Year (17/18): I, II, III, IV | 3rd Year (18/19): I, II, III, IV | 4rd Year (19/20): I, II, III, IV | 5th Year (20/21): I, II, III, IV | 6th Year (21/22): I, II

Remarks

Monitoring

- Steering Committee — Plan / Actual (Aug. 28)
- Set-up the Detailed Plan of Operation — Plan / Actual (Apr. 4; Oct. 12; May 22; Feb 4; Apr 27)
- Submission of Monitoring Sheet — Plan / Actual
- Monitoring Mission from Japan — Plan / Actual
- Joint Monitoring — Plan / Actual
- Post Monitoring — Plan / Actual

Reports/Documents

- Inception Report — Plan / Actual
- Progress Report — Plan / Actual
- Project Completion Report — Plan / Actual

Public Relations

- Seminars and Workshops — Plan / Actual

Appendix 3. Project Monitoring Sheet Ver.9

TO CR of JICA RWANDA OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version of the Sheet : Ver. 9 (Term: July, 2017 – December, 2021: 2nd Phase)

Name: Shigeo OTANI

Title: Chief Advisor/ Non-Revenue Management

Submission Date: November 6, 2021

I. Summary

1 Progress

1-1 Progress of Inputs

1-1-1 Japan Side

(1) List and Assignment Terms of Japanese Experts

a. Working in Rwanda

Table 1 Assignment Term in Rwanda (Phase 2) Working in Japan (as of October 31, 2021)

	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2017/8/5	2017/10/16	2.43
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/9/18	1.50
			2018/10/20	2018/11/29	1.37
			2019/1/15	2019/3/9	1.80
			2019/4/15	2019/6/2	1.63
			2019/7/15	2019/11/24	4.43
			2020/1/21	2020/2/15	1.06
			2021/4/28	2021/7/31	3.17
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2017/8/5	2017/9/17	1.47
			2018/5/24	2018/7/12	1.27
3	NRW Reduction Plan 1(1)	Chiaki SUZUKI/ Hiroyuki YAMAGUCHI Toru TOYODA	2017/8/5	2017/9/23	1.67
			2018/1/16	2018/3/1	1.50
			2018/5/9	2018/7/7	1.77
			2018/10/12	2018/12/27	2.57
4	NRW Reduction Plan 1(2)	Hiroyasu YODA	2017/11/8	2017/12/22	1.50
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/10/3	2.00
			2019/2/18	2019/4/6	1.60
5	NRW Reduction Plan 2(2)	Nobuyuki TSUTSUI	2017/8/5	2017/9/3	1.00
			2019/10/11	2019/11/30	1.70
			2021/3/6	2021/4/19	1.50
			2021/8/19	2021/10/30	2.47
6	Leak Detection	Junichi TAKAHASHI	2017/12/3	2018/2/15	2.50
7	Pipe Repairing and Service Connection(1)	Tokiya MOMOZONO	2018/2/5	2018/4/5	2.00
8	ICT	Shigeo OTANI	2021/3/6	2021/4/27	1.76
Total MM					49.67

Note: Man Month (MM)

b. Working in Japan

Table 2 Assignment Term in Japan (as of October 31, 2021)

No.	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2018/6/4	2018/6/8	0.25
			2019/6/24	2019/6/28	0.25
			2020/6	2020/12	5.75
			2021/1	2021/1	1.30
			2021/8	2021/9	0.60
5	NRW Reduction Plan 2（2）	Nobuyuki TSUTSUI	2019/9	2019/10	0.85
			2019/12	2020/12	7.10
			2021/1	2021/1	0.50
7	Pipe Repairing and Service Connection（1）	Tokiya MOMOZONO	2017/8/1	2017/8/10	0.40
			2017/10/30	2017/11/9	0.40
8	ICT	Shigeo OTANI	2020/4	2020/6	2.50
Total M/M					19.90

Details of each expert's assignment are shown in the Plan of Operation.

(2) List of Equipment Provided for the Project

Table 3 List of Equipment

Item	Output	Equipment	Description	Qty.	Procured by	Procurement Status	Handover Status	Date of Handover
1	2	E&M for training on pipe repairing and service connection	Pipes, piping materials and tools	1 set	KEC	Completed	Completed	2019/2/28
2		Leak detection equipment	Ultrasonic flow meter, leak detector, etc.	1 set	JICA	Completed	Completed	2019/2/28
3		Survey equipment	Portable GPS receiver, test meter, etc.	1 set	KEC	Completed	Completed	2019/2/28
4	3	Equipment for establishing Pilot DMA	Customer meters, mechanical flow meter, valves, etc.	1 set	KEC	Completed	Completed	2019/2/28
5		PRV piping materials	Pipe connectors for PRV installation	1 set	KEC	Completed	Completed	2019/2/28
6		Materials for service pipe replacement	PVC and deformed pipes	1 set	KEC	Completed	Completed	2019/2/28
7	1	Equipment for high pressure control and distribution reservoir management	PRV 12sets, Float valves 10sets, pipes and piping material	1 Unit	KEC	Completed	Completed	2020/11/26
8		Materials for pressure control	Pipes and piping material for Bypass	1 Unit	KEC	Completed	Completed	2020/11/26
9		Portable test meters	DN15, 26sets	1 Unit	KEC	Completed	Completed	2020/5/21
10		Water Level Sensor and Datalogger	Water Level Sensor, Datalogger	3 sets	KEC	Completed	Completed	2020/11/26
11		Pressure sensor and Datalogger	Pressure sensor, Logger, Data Collector	3 sets	KEC	Completed	Completed	2020/11/26
12	Cov19response activities	Engine Pump and Bulk Water Meter	Pump (DN80mm,55m3/hr, H20m) Meter (Waltman type,	23 sets	KEC	Completed	Noy yet	-

Item	Output	Equipment	Description	Qty.	Procured by	Procurement Status	Handover Status	Date of Handover
			DN50mm, PN16)					
13		Procurement material for Reduction Intermittent Water	Pipe and fittings for network repair	1 Unit	KEC	Completed	Not yet	-
14			Service pipe	1 Unit	KEC	Completed	Not yet	-
15			FV	1 Unit	KEC	Completed	Not yet	-
16	4	Monitoring System for hydraulic isolation of 4 Branches	Valve and pipes, Joint, Electro-magnetic flow meter, Mechanical flow meter, Electro Magnetic flow meter, water pressure transmitter, data logger, Server, etc.	1 Unit	JICA	Completed	Not yet	-
20	—	Equipment for project operation	Vehicle (minibus)	1 Unit	JICA	Completed	Not yet	-
			Vehicle (pickup)	1 Unit	JICA	Completed	Not yet	-
			Multifunctional photocopier	1 set	KEC	Completed	Not yet	-

Note: KEC (Kyowa Engineering Consultants)

(3) List of Facilities Provided for the Project

Table 4 List of Equipment

Facilities to be Provided

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Chambers for Pilot Areas	3 chambers for Pilot Area1 1 chamber for Pilot Area 2	set	1	Consultant	May. 2017, Sept, 2018 Completed	Completed
Lot 2	Chambers for Monitoring System	23 chambers for monitoring system	set	23	Consultant	Feb. 2019 Completed	Completed
Lot 3	Monitoring System	Data measuring and transmission facilities at 28 sites Data receiving and processing server at HQ	set	1	Contractor	Nov. 2021 Completed except manhole 3, 7 19	Not yet

1-1-2 Rwanda Side

(1) Counterpart

Table 5 Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Celestin MWAMBUTSA	Head of water distribution services, WOS, UWSS
Output 3	Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

(2) Facilities

- Office space for Japanese experts at WASAC Head Office, office furniture

- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

(3) Local Cost

- Cost for administering the Project (utilities for expert offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

1-2 Progress of Activities

1-2-1: Activities relevant to the entire Project

(1) Start-up Meeting of the Project for 2nd Phase

Start-up Meeting of the Project was held Aug. 9, 2017 with participation of members of Management Team and Action Team.

(2) Management Meeting (Joint Monitoring)

Table 6 Main items checked and actions taken in the joint monitoring

No.	Implementation period	Main items checked and actions taken	Changes to R/D, PDM, PO, etc.
Version 1	September 15, 2016	None in particular	None
Version 2	March 15, 2017	・ The activities of Output 1 (Activities 1.2 to 1.10) have been extended for about 3 months → To be completed by the end of August 2017 ・ The activities of Output 4 (Activity 4.3) has been extended due to the delay in procurement of equipment → Activities to continue in Phase 2	PO Version 1 →PO Version 2
Version 3	August 9, 2017	・Joint Monitoring Progress of each activity (preparation of 5YSP, Technical training, Pilot project, Isolation of 4 branches, Equipment procurement, others) ・Work Plan for Phase 2 Outputs ・Contents and implementation schedule of the Pilot Project	PO Version2 →PO Version3
Version 4	August 20, 2018	Progress of the Project Activities Achievements, issues and challenges Proposal of amendment of PO	Revision of RD, PDM, PO
Version 5	February 28, 2019	Progress of the Project Activities Achievements, issues and challenges Proposal for 4th year of the Project	
Version 6	May 20, 2019	Progress of the Project Activities Achievements, issues and challenges	Revision of PO
Version 7	November 19, 2019	Progress of the Project Activities Achievements, issues and challenges	Revision of PO

Version 8	March 23, 2021	Progress of the Project Activities Achievements, issues and challenges	Revision of PO
Version 9	November **, 2021	Progress of the Project Activities Achievements, issues and challenges	

(3) Steering Committee (SC)

The results of holding SC meetings and future plans and agenda are as shown in the table below.

Table.7 The held time of the SC meeting and the agenda

Time	Holding time	Theme, contents
1st	April 3, 2017	・Discussion of the work plan (WP1), approval ・Confirmation of the Rwandan side burden matter
2nd	October 12, 2017	・Progress confirmation of the project ・Common knowledge of the NRW reduction 5YSP ・Approval of the second work plan ・About the enforcement of the project evaluation
3rd	August 28, 2018. At the time of Project Monitoring by JICA	・Result of Joint Monitoring ・ Procurement and Installation Plan of the Equipment for Monitoring System ・Monitoring result of the JICA Monitoring Survey Mission
4th	May 22, 2019	・ Progress of the Project ・ Rescheduling of Equipment Procurement and Installation of Output 4 ・ Additional Activities ・ Revised Work Plan for Phase 2
5th	February 4, 2020	・Progress and problems in the procurement and installation of equipment in the Output 4 activities ・Extension of the Project period ・ Progress of other project activities
6th	April 27, 2021	・Progress of the activities of the Project ・COVID-19 response supported from JICA ・Revision of the Plan of Operation after resumption of the work in Rwanda
7th	At the time of project completion, scheduled in Oct 2021	・Progress of the activities of the Project ・Project evaluation and recommendation for way forward

(4) Weekly Meeting

As a rule, PIM meetings are held basically at the end of every week and the activities for the week are reported, the activities scheduled for the following week are confirmed and pending issues, matters of concern, requests, etc., are discussed. The meetings are also utilized as a venue for training through seminars and workshops on matters proposed by the experts, etc. Meetings have been held 101 times as of the end of March 2021 (including thirty times in Phase 1).

(5) Project Progress Report (Part 6)

Project Progress Report (Part 6) was submitted to JICA and WASAC in January 2021.

1-2-2: Training in Japan and in the 3rd Country

(1) Training in Japan

Table 8 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5	- Introduction to water service management and NRW - Outline of water facilities in Yokohama and Kobe Cities and other matters
2	August 14 to 30, 2017	Business affairs and GIS matter	5	- Introduction to water service management and NRW - Customer information management, meter management and reading, and water service management - Examples of how local governments utilize GIS, purposes of use, and other matters
3	Nov. 13 to 30, 2017	Technical matter	5	Introduction to NRW, pressure management, leak detection, distribution management, and other matters

(2) Training in the 3rd country

Training in the 3rd country was conducted as shown in the table below.

Table 9 Training in the 3rd country

No	Country	Timing	Field of training	Trainees	Training Themes
1	Kenya	May 7 to 10, 2018	Management Team	2	An introduction and discussion of activity on NRW reduction carried out in Kenya (WASREB, MWI, KEWI, NYERI)
2	Malawi	Sept 22 to 27, 2019	Management and Action Teams	5	An introduction and discussion of activity on NRW reduction carried out in Malawi (LWB, EWASCO)

1-2-3: Activities of Output

【Activities of Output 1】： Planning capacity of NRW reduction of WASAC is enhanced.

1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.

Members of the Team were appointed in August 2016. Some change was made in September 2017.

1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

Questionnaire survey, site visit survey for Branches, discussion in a series of Workshops and assessment of root causes of identification problems were done.

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

Discussion in a series of Workshops have been conducted. Framework of Action Plan was approved in

the seminar on May 29, 2017.

1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

The implementation of the activities for identifying reservoirs that required urgent repair for overflow, one of the causes of water leakage, and repairing equipment in the facilities of the reservoirs, was proposed at the 4th SC. The functional survey of the 36 existing distribution reservoirs at the 26 sites in Kigali selected by the branch offices of WASAC was conducted in July and August 2019. The survey revealed that the distribution reservoirs at nine sites are in the greatest need of urgent repair. To prevent overflow from the identified reservoirs, float valves (FVs) were procured and installed in the reservoirs.

In the above-mentioned work, a discrepancy was found between the number of distribution reservoirs at 158 sites in Kigali in the GIS list of WASAC and the number of the existing reservoirs. It was also revealed that the reservoirs had not been named systematically and the structures and functional state of facilities of each reservoir were not known. In addition, the survey found overflow water leakage due to the absence or defect of FVs at many reservoirs. Based on these observations, it was decided to conduct an inventory survey to elucidate the functional state of the distribution reservoirs as an activity for Output 1. The results of the survey were to be used as the basic data for the implementation of 5YSP activities in the future.

The first survey of the distribution reservoirs was conducted between May and August 2020. The branch offices selected 55 reservoir sites where they found problems among the 158 sites in Kigali for the survey. Engineers were hired for the survey. The staff of the NRW Control Services, GIS Team, and branch offices of WASAC also participated in the survey. The same survey was conducted for the second time at 61 sites in September and October.

Based on the results of the surveys mentioned above, the list of the reservoirs in Kigali was updated. WASAC will create a database of the updated list for sharing and use the list as baseline data for the preparation of the plan for a 5YSP activity, functional improvement of the distribution reservoirs in Kigali. The reservoirs requiring the installation or replacement of FVs have been identified and the BOQ for the required equipment have been prepared.

The number of facilities to be surveyed is huge and the resources are limited. The priority was done to distribution reservoirs in Kigali and bulk meters assessment in almost all WTPs. As way forward, the survey method will be incorporated into NRW reduction manual. Dissemination will be done for all branches and WTPs in order to conduct the survey by themselves. Upcountry reservoirs survey and bulk meter assessment will be performed by WASAC.

As the result, the equipment procurement quantity to be carried out by 5YSP will be clarified.

Following quantity surveys by Branch are in progress.

- ✓ Water distribution pipe for replacement

- ✓ Service pipe replacement
- ✓ PRV installation survey

1-5 Based on the results of Activity 1-3 and 1-4, management team prepares a draft of 5YSP.

The Final Draft of the 5YSP was completed in September 2017, and was approved at the 2nd SC which was held on October 12, 2017.

1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

Although WASAC planned to reform its organizational structure with MININFRA's approval (March 2017), the reform plan has not been implemented.

WASAC reviewed its organizational structure again and the organizational gaps have been identified through the implementation of the 5YSP. It is necessary to consider organizational reform to promote the implementation of 5YSP. For example, the review WASAC structure to be more responsive and efficient. WASAC management recognized the importance of the organizational change and the re-structuring process is on-going.

Based on the proposal at 5YSP, WASAC is currently entrusted with a consultant.
Applying for the following increase in the 5YSP update report of September 2021.

- ✓ Quick and quality repairs, for Kigali Branch (1eng+2tech)
- ✓ Inspection and enforcement of water theft, for NRW unit (2 officer and 3 operators)
- ✓ Recruitment of staffs for NRW unit

1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP

A yearly implementation schedule for each specific action was prepared. As a future issue, it is necessary for each branch office to draw up individual detailed action plans, including construction of the facilities and procurement of the equipment (equipment for surveys and operation of water distribution system). Specific actions, which can be performed in 5YSP, are to be incorporated sequentially in the annual action plans of each branch for the time being.

1-8 WASAC secures budget in accordance with the priorities for the next fiscal year.

The NRW activity is being performed as a work activity within the normal budget (Utility Budget: current expenses, and OPEX: maintenance expenses) and there is need for budget implementation that is more specific to the activity items.

Therefore, the budget should be allocated to each branch for the implementation of branch-specific NRW reduction activities, however the budget has not been executed in accordance with the budgetary requests of the branches.

Insufficient annual budget doesn't not yet cover most of NRW reduction activities. CAPEX required for the NRW reduction seems to be huge compare to current available budget. WASAC should think about other sources of funds to support NRW reduction activities (OPEX and CAPEX).

1-9 The management team prepares the 5YSP that summarizes the achievements from Activities 1-1 to 1-7.

A management meeting attended by all DUWSS managers and all section heads was held on November 14, 2017, and the latest edition of the report was explained. The result was reported to the CEO and the Branch Managers the next day.

A report was submitted to the Senior Management Team by the project director Mr. Methode on December 15, and the report was approved in the Senior Management Meeting held on February 12, 2018. 5YSP was finally officially approved by the WASAC Board of Directors on April 27, 2018. After responding to the comments received, the final approval of the WASAC Board of Directors was obtained on April 27. Implementation of the plan has been delayed by 1-year relative to the schedule, and will be commenced in fiscal year 2018/2019.

1-10 The management team holds seminars and presents 5YSP (Activity 1-8) for WASAC and other concerned parties.

5YSP was shared with the relevant persons in MININFRA and WASAC at the SC meeting on October 12, 2017.

The Project Manager and JICA expert had visited all WASAC branches between April and July 2018 and explained 5YSP to the staff members of the branches to make all of them understand it. The recording format for the monthly 5YSP activity report required for the explanation was finalized.

An in-house workshop was held in WASAC on July 19, 2018, to identify activities required for achieving the goal of the first year of the Non-Revenue Water Reduction 5YSP from the progress of and the problems found in the implementation of the plan.

1-11 The management team facilitates implementation and the monitoring of the 5YSP.

Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018.

Monitoring is carried out every quarter in accordance with the reports (monthly reports) from the branches. Monitoring started in July 2018. The contents of the reports are evaluated and a workshop on the reports is held every quarter.

The NRW Section, DUWSS, WASAC, prepared the quarterly monitoring report for fiscal year (FY) 2019/2020 4Q and submitted it to the Monitoring Team on September 25th, 2020. With the submission of the report, the activities in the second year of the project, FY 2019/2020, was completed. A workshop on the report was held on October 8th, 2020. The participants in the workshop evaluated the implemented NRW-reduction activities and discussed the ways to promote 5YSP in the future.

1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.

Initially, this activity was planned to be done by the Project. However due to the emergency to comply with RURA, this document was done by Commercial Directorate of WASAC (Connection Policy, Jan, 2019).

The reports on new connections in the 5YSP monthly reports confirmed whether the new connections had been established in accordance with the guidelines. But WASAC has not been able to provide guidance on strict compliance with the guidelines. And, it was observed the need to revised again the new connection policy in order to ensure customers procured material are good quality. Because it has been confirmed that most of leaks are coming from service pipes (poor quality).

The gap between the policy and its implementation is still also a problem. As countermeasure, WASAC should review the new connection policy and the enforcement of its implementation.

New connection policy will be proposed in the next technical cooperation project.

1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

Insufficient budget allocation is a problem in the implementation of the NRW reduction activities.

1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

The finalized 5YSP report will be announced.

【Activities of Output 2】:

Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2-1 Training materials on NRW control are prepared.

Done.

2-2 Training on NRW management is conducted for the management team and WASAC

management as necessary.

Done.

2-3 OJT is conducted on the updating of GIS data, using available GIS data base.

Done.

2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

Done.

2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

Done.

2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

Done.

2-7 In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

Done.

2-8 Training materials on NRW are reviewed and updated.

The team has compiled the manual based on the various training materials used in the Output 2 activities and adding the methods of activities practiced in the Output 3 pilot project to those materials. The manual shall be used in the formulation of training programs.

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

The Directorate of Support Services (SSD) is responsible for the training programs in WASAC. The training programs in the Project should be incorporated into the training scheme of the entire WASAC to disseminate the NRW control technology to all staff members of WASAC. The cooperation between the NRW Control Services and SSD shall be strengthened for the technology dissemination.

The training is to be planned for the eleven subjects mentioned below that have been recognized as activities with high short-term effects in the Pilot Project and recognized as important subjects in the Pilot Project activities.

Table 10 Training Courses on NRW Reduction Activities

Item	Subject
1	Introduction to NRW Reduction Activities
2	High-Pressure Control
3	Water Distribution Control
4	Leakage Surveys and Repair
5	Replacement of Water Supply and Distribution Pipes
6	Management of Distribution Reservoirs
7	Control of Volume of Water Distribution
8	Maintenance of Charge Collection Data and Customer Meters
9	Monitoring of NRW Rates
10	Preparation for NRW Reduction Activities
11	Handling of Survey Equipment

The expected final result is that the training program formulated by this project will be incorporated into WASAC's human resource development plan.

The core person of the dissemination of the manual on NRW reduction activities have been trained in the NRW project. The training can be conducted mainly by NRW Section staff of DUWSS, regardless of the WASAC training course implemented by Supporting Service.

【Activities of Output 3】

: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

3-1 The action teams are organized to conduct NRW reduction measures at Pilot Areas.

Member of the Team were appointed in August 2017.

3-2 The action team grasps the current situations of Pilot Area 1 and Pilot Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.

Done.

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Pilot Area 2.

Done.

3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1and 2.

Done.

3-5 The action team establishes the baseline NRW rate of Pilot Area 1 and Area2

Done.

Area1: Baseline: Mean value of June, July 2017. NRW Rate is: 37.3%
Area2: Baseline: Mean value of March, April 2018. NRW Rate is: 68.4%

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1 and Area 2.

Area1: The existing 327 customer meters were replaced with the new one by the result of on-site meter test (total surveyed 1,172).

Area2: General meter visual inspection for all customers 1,703 was conducted. In this, 135 were replaced by the result of on-site meter test.

3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness

Effect was evaluated on three comparisons cases of before and after replacement. 1) NRW rate, 1) Average errors per meter, 3) Water Consumption volume.
The result of meter test shows that the effect of meter replacement was quite negligible.

3-8 The action team conducts measures for reducing surface leakage (visible leakage).

Area 1: In process as daily routine work of Branch office
Area2: Large quantity of the existing leakage was measured. Visible leakages were found at 16 places in March, 14 places in July and August.

3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

Done.

3-10 The action team conducts measures for reducing underground leakage (invisible leakage).

Area 1: Done.
Area2: Step test was conducted during May to July 2019.

3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

Area 1: Done
Aria 2: Qmnf measurement was conducted during June to September 2019.

3-12 The Action team conducts measures for reducing high water pressure.

Area 1: PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block. PRV at PM1 was set in September 2019.

Aria 2: Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept., one in RY2 in Oct., 2018. Additionally, one each in RY1 and RY3. Ball valve in RY1.

3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.

Area 1: The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.

Aria 2: The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. NRW rate before and after PRV adjustment was compared in A2 (Small DMA). Also, Qmnf before and after setting PRV was compared. Qmnf was measured.

Planned pilot activities in the pilot area were completed, although some equipment (Bulk meter, 2PRVs) was defected. The replacement took time because of limited maintenance budget from the Project and WASAC.

For the sustainability of NRW reduction it should be continued to monitor the Pilot area (reading index, calculation of the NRW, progress). WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities using lesson learned from the Project.

3-14 Cost-benefit Analysis of NRW Reduction Measures

As the NRW ratio in Pilot Area 1 had reached the target value in January, February and March 2019, the cost benefit analysis of the NRW reduction activities in the area was implemented in April 2019 to elucidate the effectiveness of the project. The achievement target for Area 2 is high. As the water supplied from the Nzove Pumping Station was distributed directly through a pipeline that bypassed a distribution reservoir (bypass pipeline) in this area, the water distribution pressure was high. This high pressure was a major cause of water leakage. Although the pressure control in the night and the pressure adjustment in areas with large existing leakage had been implemented, these measures failed to produce the expected NRW reduction.

Although the NRW reduction achieved by these measures was limited, the cost-benefit analysis of these measures proved that they had an NRW reduction effect.

- The calculation of the NPV and B/C values clearly shows the effect of the NRW reduction activities (NPV>0 and B/C>1) in each case, while the values varied from year to year.

In conclusion, the investment in NRW reduction activities had sufficient effect when the activities reduced the NRW rate to a certain degree (by approx. 10 %) even if the rate was very high like in

Ruyenzi (68 %). Therefore, it is important to actively promote cost-effective activities, such as the reduction of high-water pressure (installation of PRVs) in the pipes, surveys and repair of water leakage (underground water leakage, in particular), and replacement of water supply and distribution pipes.

In Pilot areas (Ruyenzi), the target value (25%) could not be achieved, due to poor quality water pipes and high pressure. As countermeasure, it is necessary to continue NRW reduction activities in this Pilot Area. Replacement of small-diameter HDPE pipes which has high leakage is being conducted. Materials have been procured in response to Covid-19 prevention measures, and WASAC should replace existing pipes as soon as possible.

3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project 1, and submits it to the management team.

The JICA Expert Team has completed the preparation of the completion report and explained and submitted it to WASAC.

Pilot Area 1 : Submitted to WASAC in October 2019
Pilot Area 2 : Submitted to WASAC in January 2020

WASAC is studying the report and preparing comments on it. The comments of WASAC shall be incorporated in the completion report and the knowledge acquired and lessons learned from the pilot project activities shall be reflected in the 5YSP.

3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.

The action team invited the heads of Kacyiru and Nyarugenge Branches that were responsible for the water services in Pilot Areas 1 and 2, respectively, to a seminar held on February 14, 2020.

When the completion report has been finalized after the second review by the C/P, the action team shall hold a workshop on the report for all WASAC staff.

3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

It was decided to set up the manual preparation team of the pilot project inside WASAC and prepare the manuals in coordination with this team. The manual preparation meetings were regularly held after the kickoff meeting held on January 29th, 2019.

The Pilot Project Completion Report and the NRW-reduction Manual have already been prepared. WASAC shall hold an in-house workshop to disseminate the report and manual in WASAC.

【Activities of Output 4】:

4 branches in Kigali establish the system to measure NRW rates accurately.

4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

Done.

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

Done.

4-3 Chambers are constructed as appropriate.

Done.

4.4 Electromagnetic flow meters and pressure gauges to be procured and installed

JICA will be responsible for the procurement and installation of the monitoring equipment. JICA will employ a contractor for the procurement and installation. In accordance with the original plan of holding the tender for the procurement and installation of the equipment in Kigali, JICA announced the invitation to the tender on May 26, 2017. The tender failed in October 2017 after all bidders had been disqualified because their financial states and/or the technical specifications of the equipment in their bid proposals did not meet the tender requirements. Therefore, JICA decided to hold another tender for a blanket contract including the installation work at its headquarters.

Tenders were submitted on July 23, 2019, and the contract with Takaoka Engineering Co., Ltd. was concluded on September 20. Takaoka Engineering conducted a site survey. The kickoff meeting and a wrap-up meeting were held in September 2019.

However, subsequently the Project was suspended since March 2020 until March 2021 because of the prevention against COVID-19 pandemic. The construction was resumed in march 2021 when the circumstances became to Japanese engineers was able to supervise it on-site.

The installation of the equipment was completed at the beginning of September, 2021. Pre-SAT, SAT and O&M training for WASAC staffs were conducted from the end of August to beginning of September 2021. The training of the NRW rate calculation continues to progress. The remaining works are to complete following tasks of WASAC:

- To complete the transfer of customer registrations as the branch-to-branch boundary is moved.
- To replace default meters installed in SUSWAS project at an early time.
- To train WASAC team to properly operate the installed NRW monitoring system

4.5 System input to each of 4 branches to be measured

After construction of the monitoring system, measurement data on the quantity of water distributed to

each branch within Kigali City (input water quantity) will be continuously collected in day units. The data will be accumulated on a server in the central server room. Using this data, the NRW percentage of each branch will be calculated. The calculation of the NRW percentage will be carried out in Excel file format. The NRW percentages obtained will be used as indexes for NRW reduction activities in each branch, so they will be used for reviewing the 5YSP.

4.6 Based on the results of Activity 4-5, NRW rates for each branch to be calculated and reported

On-the-job training (OJT) for the NRW percentage calculation software was scheduled to be implemented over 3 months after construction of the monitoring system.

A draft version of the NRW rate calculation software was prepared. On November 1, 18 and 26, 2019 meetings were held for key persons in UWSS, which is the main department that will use the software, and other departments involved in maintenance. Details of the calculation software, method of use, and training schedule were explained, and their understanding was obtained.

After completion of monitoring system on September 9, 2021, improvements were made with respect to requests for ease-of-use from the WASAC side, and the NRW rate calculation software was completed through the training (OJT) of WASAC staff between September and November, 2021.

Actually, NRW rate of October was calculated and reported by using the billing data of CMS and distribution flow data collected from monitoring system.

1-3 Achievement of Output

(1) Output1 Planning capacity of NRW reduction of WASAC is enhanced.

Indicator 1-1: 5 YSP is reviewed and updated, taking into account of the results of the Pilot Project.

The Preparation of this 5YSP began in August 2016 in the framework of JICA technical cooperation to strengthen the capacity of NRW control in WASAC, this exercise involved WASACs directorates, unit, branches and Water treatment plants through interviews, questionnaires, field visits and workshops. The NRW reduction measures implemented in WASAC were assessed by consulting different WASAC reports, field visits to assess the network condition, interviews with different WASAC officials, branch managers and Head of water treatment plant.

In July 2018, WASAC started the implementation of the 5 Years Strategic Plan (5YSP) for NRW reduction as a tool to monitor the implementation of NRW activities considering the targeted NRW rate of 25 % in 2023.

The Project updated or added/modified some indicators in the 5YSP after reviewing the monitoring results of the pilot project.

The Project held a review workshop inviting primary members including managers to look back and update the 5YSP in July 2019. The participants evaluated the achievements of the pilot project according to monitoring indicators as well as discussed necessary additional further actions. The workshop concluded some updates of implementation and monitoring plans with new indicators.

Primary indicators updated/added are as follows:

- Number of PRV installed
- Number of customer meters replaced
- Number of customer inspections conducted
- Number of customer meters inspected their accuracy

WASAC plans to review and update the plan continuously with official approval of the WASAC's board.

After 3 years of its implementation, at the end of September 2021, revision of 5YSP is considered to adjust and incorporate the activities from the findings through the implementation of the 5YSP, pilot project result and recommendations from Kigali water supply Master plan recently developed by Japanese experts.

Indicator 1-2: All the project achievements are shared by WASAC and other concerned parties by holding seminars.

- Sharing information within WASAC:

All the progresses and challenges the Project encountered are being shared though various workshops, seminars, management meetings, and SC meetings.

- Sharing information with concerned parties:

MINIFRA as a major stakeholder has participated in SC meetings. Information and lessons of the Project have been well shared.

The Project will hold a final seminar (7th SC) to present all the achievements of the Project by the end of the Project period.

Overall assessment:

The Project has achieved the Output 1 as of the Terminal evaluation.
It can be evaluated that the cycle of Plan-Do-Check-Action, PDCA cycle, has been well applied in WASAC's job place.

(2) Output2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.

Indicator 2-1: More than 300 number of trainees receive training.

The Project has conducted many types of trainings. The total number of trainees counted to 596 as of the Terminal evaluation.

Indicator 2-2: WASAC human resource development plan includes training programs prepared by the project.

The Support Service Department, SSD, is in charge of training plan and implementation in WASAC in accordance with the human resource development plan. The training program widely covers various technical topics, inviting internal trainers as well as external trainers from other organizations.

The outputs of the Project, training program on NRW reduction, will be a part of entire training program of WASAC. Discussion between the NRW unit and the SSD is about to start after finalization of technical manuals as training texts, which are now at the last stage of checking the contents.

- The core person of the dissemination of the manual on NRW reduction activities have been trained in the NRW project.
- The training can be conducted mainly by NRW Section staff of DUWSS, regardless of the WASAC training course implemented by Supporting Service.
- Cyprien convened branch employees in July? this year to provide guidance on the analysis of commercial data.
- The NRW unit can go to the branch office and guide the staff the distribution reservoir functional survey.
- Although the NRW unit can provide guidance on leakage survey, the number of staff is being requested by the proposed 5YSP update due to the lack of human resources at the branch.
- In order to analyze the implementation data of 5YSP activities, the strengthening of the number of personnel of the NRW team is requesting in the proposed 5YSP update.

Overall Assessment:

The Project has almost achieved the Output 2 as of the Terminal evaluation.
As of the Terminal evaluation, although training programs prepared by the Project has not been materialized yet in the entire training programs of WASAC, it is highly possible to be done by the end of the Project.

(3) Output3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

Indicator 3-1: NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.

Result of NRW rate were not to reach the target figures.

Pilot Area 1: 25% (2019/20)
Pilot Area 2: 56% (2019/20)

NRW's reduction target was not achieved, but it was proven to be beneficial. The investment in NRW reduction activities had sufficient effect when the activities reduced the NRW rate to a certain degree (by approx. 10 %) even if the rate was very high like in Ruyenzi (68 %). (See 3-14)

Pilot Area 1:

Maintaining the installed facilities is quite important to keep and/or reduce the NRW ratio especially after the implementation of NRW reduction activities with equipment installation, however PRV at the PM 2 and 3 have had mechanical problems since June 2019, then water pressure has not been controlled as expected. Only PRV at the Sub-Block 1 has been functioning well. This is considered as a part of reasons of the current status.

Pilot Area 2:

PRV has been contributing to NRW reduction up to the certain level; however, it is difficult to reach the target figure. Considering the geographical condition of the target area, following measures are additionally required; 1) necessary to conduct pressure control more segmentally by altitude basis; and 2) necessary to reinstall water service pipes and to redesign water distribution network.

This nonattainment situation should be also analyzed from the viewpoint of the level set as the target figures. Firstly, the Project set the target figures at rather challenging level. Secondly, NRW rate reduction can be attained by not only excellent manpower but also material inputs including infrastructure and equipment. NRW reduction requires approaches from both sides. Moreover, thirdly, the target area is located at quite challenging geographical condition for NRW reduction with huge difference of elevation. Considering such feature of NRW reduction at this target area, the Project has faced difficulties in terms of reaching the target figure.

Indicator 3-2: Action team members share experiences at workshops regarding implementation of the pilot projects.

In the same manner as the indicator 1-2, the Action team members shared experiences and lessons through workshops and a variety of meetings.

Indicator 3-3: The action team prepares a completion report of the pilot project.

The draft completion reports of the pilot project were already presented to WASAC from the JICA experts in October 2019 for the Pilot Area 1 and in February 2020 for the Pilot Area 2. WASAC will

review and finalize them through workshops.

Overall Assessment:

The Project has almost achieved the Output 3 as of the Terminal evaluation.

The aim of this Output is to enhance capacity to cope with expected and unexpected events at working fields, employing the technical knowledge and skills obtained in the Output 2.

Through implementation of the pilot project, WASAC developed their technical capacity on NRW reduction. Actual experiences at working fields directly contributed to enhancing their technical proficiency. Followings are the major technical items which the counterparts enhanced: formulation of DMA; conducting tests of customer meters, planning and conducting leak detection survey including step test and Qmin measurement; management and control water pressure; planning of replacement of aged and substandard pipe, making customer mapping.

In addition, the cost benefit analysis of countermeasures to NRW reduction was conducted in the framework of this Output, and concluded their countermeasures economically viable.

Overall, although one of the key indicators, reduction of NRW rates, have not been fulfilled yet, the essential goal of this Output, which is to enhance technical capacity to cope with actual working field and identify the major cause of NRW and each countermeasure has been developing as expected. The Output 3 can be evaluated “almost achieved” in this context.

(4) Output4 4 branches in Kigali establish the system to measure NRW rates accurately.

Indicator: NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.

The construction of the monitoring system ended in September.
Training to calculate the NRW content in the data obtained from the monitoring system is being carried out.

Overall assessment:

The Project has not achieved the Output 4 yet as of the Terminal evaluation.

The system to measure NRW rate has not been installed yet due to delay in equipment procurement and influence of COVID-19 situation. OJT for NRW rate calculation and reporting by using data obtained from monitoring system is also planned after the equipment installation.

Besides, it should be noted that the Project’s system plans to be operated together with monitoring network of SUSWAS project. However, the system by SUSWAS is currently out of order. In order for the Project’s system to function completely, repairing works of SUSWAS system by WASAC is

indispensable.

In addition, re-registration of customers whose residential location lie in boarder area of the targeted branches should be completed.

1-4 Achievement of the Project Purpose

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.

Indicator 1: 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.

The 5YSP for NRW reduction was approved on the 27th April, 2018 by the Board meeting of WASAC where a representative of MINIFRA also attended.

Indicator 2: Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC

Each branch has annual action plan for NRW reduction which shows necessary actions such as PRV installation, meter replacement, leakage survey, and others. Their plans comprise a part of the annual action plan of entire WASAC.

Indicator 3: The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction

The indicator 3 has not been achieved, or in other words, the achievement status is moderate at this moment. This indicator contains two different issues, firstly, recognition of the effects of NRW reduction by WASAC management strata, and secondly, budget approvement.

The management strata of WASAC fully recognized the effectiveness of NRW reduction measures through the pilot project and already extended the same countermeasures such as installation of PRV and float valve, FV, balk meter assessment, customer analysis, customer inspection, on site meter testing, customer meter replacement outside of the pilot project area.

On the other hand, budget allocation for branches on NRW reduction has been facing immense challenges. In the case of the year 2019/20, although WASAC headquarter approved annual action plans, the actually allocated budget for NRW reduction works was lower than the planned budget. The difference created discrepancy between the plan and the actual activities.

Overall assessment:

The Project purpose has been almost achieved.

Towards the Project purpose "enhancement of WASAC's capacity to conduct NRW reduction measures", the Project took approaches from four (4) aspects, 1) planning aspect, 2) technical aspect, 3) applied technical aspect, and 4) establishment of NRW rate measuring system. As the achievement status of the Output 1 shows, WASAC has been steadily implementing and monitoring NRW works in accordance with the 5 YSP by PDCA cycle. In 2) technical aspect, WASAC's staffs acquired knowledge and skills through a series of trainings in the Output 2. Capacity to cope with actual situations/challenges at working field is also enhanced through the pilot project, as 3) applied technical capacity, the Output 3. Only 4) as the Output 4: establishment of NRW rate measuring system is still remained.

On the other hand, looking at fulfillment status of the indicators, it has to be pointed out that actual budget allocation is not matched with annual action plan. Since WASAC itself cannot increase its organization's revenue without raising water tariff as an independent corporation status, this insufficient situation is not attributed to WASAC; however, this deviation of NRW action plan is strongly influential on WASAC's NRW reduction efforts on the basis of the acquired technical skills by the Project.

In conclusion, although the Project has challenges on budgetary aspects, the Project activities successfully led to capacity enhancement of WASAC. Subtracting the indicators' moderate achievement status, the Project purpose is evaluated "almost achieved".

1-5 Achievement of Overall Goal

WASAC conducts NRW reduction measures as planned for Kigali city.

Indicator: NRW rate of Kigali city (year 2022/23 : 25 %)

Achievement status of the Project outputs is observed according to the PDM indicators. Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017 (40.3 % on the average of 2019/20)

It is highly prospected that WASAC continues to apply NRW countermeasures, which enables to reduce the NRW rate step by step; though, it may take more time until reaching the indicator's level than the target year.

Lessons from the pilot project successfully specified prioritized countermeasures including 1) water pressure management, 2) distributing reservoir management, 3) replacement of aged and substandard pipes, 4) quick and quality pipe repair, 5) water billing data management, and 6) customer meter management.

However, immense budget is required if all of them take in place especially 1) water pressure management and 3) replacement of aged and substandard pipes. Therefore, achievement of the Overall goal is heavily dependent on securement of budget of WASAC from now on.

- The activities and budgets required to achieve the Overall Goal of the Project are shown in the 5YSP update created by Mr. Bahige. It is pending approval by WASAC management.
- However, large investments such as the ongoing RSWSSP are not included in the budget for NRW reduction measures presented to the 5YSP.
- Kanzenze, Nzove's water treatment plant, AfDB's construction of trunk facilities, etc. have already started and projects to increase water distribution have already started, but the NRW reduction measures have not caught up with it at all. A survey of the " NRW reduction of Northern Area in central Kigali " (mainly 12 water distribution blocks in the Kacyiru branch area, 9 reservoirs and elevated water tanks, 54 km of water distribution pipes, about 200 km of water supply pipes) will be carried out soon, but the construction plan is in 2023/24, and the effect will appear after January 2025. In addition, the funding sources for large-scale facility improvement such as replacement of distribution and service pipe, high pressure management, and reservoir management have not materialized.
- Basically, investments for these NRW reductions should be made before increasing water distribution. The order is opposite to try the water distribution amount increase without taking measures against the leakage of the distribution and service pipe, and, for example, it is the same as injecting water fast into the bucket of the deep bottom where there are holes with the water leaks.
- In recent years, the NRW rate in Kigali City has been on an increasing trend (2.6%/year), and from the above-mentioned facts, it is not realistic that the Overall goal of PDM can be achieved at all. Therefore, in the updated version of 5YSP, the target for FISCAL 2022/23 has been revised downward to 38% based on the actual value of 43.3% for year 2020/21.

1-6 Changes of Risks and Actions for Mitigation

Due to covid-19 infection prevention measures, JICA has banned business travel from March 2020. It resumed in March 2021, but for this one year, it has been working remotely using the Internet with counter parts and with local staff, but the decrease in efficiency cannot be denied. In particular, we were forced to stop the procurement and installation of equipment for the Output4 monitoring system.

1-7 Progress of Actions undertaken by JICA

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment was procured in July 2017.

- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is behind the schedule.

1-8 Progress of Actions undertaken by Rwanda side

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Preparation of 5YSP for NRW reduction.
- Joint visit JICA-WASAC of WASAC's upcountry branches.
- Training in Japan
- Training in the third Country

1-9 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

None

2. Delay of Work Schedule and/or Problems

In view of the delay of the Project caused by COVID-19, it was decided to extend the project to December 2021 in December 2020.

II. Project Monitoring Sheet I & II

As attached.

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 9

Implementing Agency: WASAC

Dated November **, 2021

Target Group:WASAC staff engaged in Non-Revenue Water reduction

Period of Project:2021/12/31

Project Site: 6 Branches in Kigali city(Kacyiru, Nyamirambo, Gikondo, Nyarugenge, Remera and Kanombe ）

Model Site:

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement
Overall Goal				
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city （year 2022/23 : 25 %） → 38% (Revised in 5YSP update September and approved by WASAC Management)?	Monitoring report of 5YSP	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25%. Achievement in 2021/2022 was 42.2%. NRW rate 17.2% must be reduced in two years to achieve the target by the end of 2022/23. Considering the NRW rate achievement for the last past 3 years (above 40%), it seems to be not practicable to achieve the set target (25%) in the remaining two years. It is in this regard that the target to achieve for the year 2022/2023 is revised to 38%. Achievement of the Overall goal is heavily dependent on securement of budget of WASAC and assistance fund from development partners.
Project Purpose				
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction (5YSP) is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The non-revenue water section at WASAC is not subject to large scale reorganization. WASAC staff do not resign after training by the Project. Large scale natural disaster dose not occur.	1. 5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware. 2. The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area. Though in the future more specific actions for NRW reduction is needed. NRW reduction Branches annual budgets should be incorporated in the company NRW reduction budget. 3. The budget of NRW reduction activity was decided in WASAC Action Plan. On the other hand, that budget is not fully allocated at an implementation level for branches on NRW reduction. In the case of the year 2019/20, although WASAC headquarter approved annual action plans, the actually allocated budget for NRW reduction works was lower than the planned budget. The difference created discrepancy between the plan and the actual activities.
Outputs				
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project		1.1 5YSP is being updated considering the result of it's implementation for past 3 years, findings from the pilot project and observation from the MP study. The draft of the updated version was submitted at the end of September and will follow the approval process. 1.2 All the progresses and challenges the Project encountered are being shared though various workshops, seminars, project management meetings, and SC meetings. MININFLA as a major stakeholder has participated in SC meetings. Information and lessons of the Project have been shared. All the achievements of the Project are presented in the 7th Steering Committee of the end of the Project period.
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		2.1 596 cumulative number of trainees were received training (60 numbers of the staff). 2.2 The core person of the dissemination of the manual on NRW reduction activities have been trained in the NRW project. The training can be conducted mainly by NRW Section staff of DUWSS, regardless of the WASAC training course implemented by Supporting Service. Although the NRW unit can provide guidance on leakage survey, the number of staff is being requested by the proposed 5YSP update due to the lack of human resources at the branch. In order to analyze the implementation data of 5YSP activities, the strengthening of the number of personnel of the NRW team is requesting in the proposed 5YSP update.
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%. 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		3.1 Result of NRW rate were not to reach the target figures. Q3 of 2019/2020 (in March 2020) Pilot Area 1: 25% Pilot Area 2: 58% 3.2 In the same manner as the indicator 1-2, the Action team members share experiences and lessons through workshops and a variety of meetings. 3.3 The draft completion reports of the pilot project were already presented to WASAC from the JICA experts in October 2019 for the Pilot Area 1 and in February 2020 for the Pilot Area 2. WASAC will review and finalize them through workshops.
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		4.1 The construction of the monitoring system to measure distribution volume of isolated each 4 Branch area in Kigali was completed in September 2021. Thereafter, training was performed to calculate the NRW rate by data obtained from the monitoring system. 4.2 WASAC must install following 16 flow meters to incorporate the measurement data into the monitoring system. ・Replacement of existing malfunction meters installed by SUSWAS project (5 locations) ・Installation of meters at newly increased branch boundary points due to AfDB project (11 locations)

Activities	Inputs		Pre-Conditions
	The Japanese Side	The Rwanda Side	
1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.			
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser／Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.	GIS	Management team members	WASAC staff do not resign after training by the Project.
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	Large scale natural disaster dose not occur.
1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Leak detection	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	2 Training		
1-11 The management team facilitates implementation and the monitoring of the 5YSP.	Training in Japan		
1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	Training in the 3rd country		
1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.		2 Facilities	
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.		Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections Training room with the capacity of about 20 persons	
2-1 Training materials on NRW control are prepared.	3 Equipment provision		
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.	Equipment and materials for training on pipe repair and service pipe connection	Space for training on pipe repair and service pipe connection（40㎡）	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	Leak detection equipment	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Equipment for survey (Mobile GPS etc.)		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Equipment for formation of Pilot DMAs	3 Local cost	
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Materials for service pipe replacement of Kadobogo Pilot Area	Cost for administering the Project (utilities for experts offices, internet services)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Equipment for high pressure control and distribution reservoir management (PRV, FV)	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8 Training materials on NRW are reviewed and updated.	Portable test meters (26 sets)	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Water level sensor and Pressure sensor, with datalogger (3 sets)	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Engine pump and Bulk meter for emergency water supply of COVID-19 response (23 sets)		
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Equipment and materials for Reduction Intermittent Water of COVID-19 response		
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	Equipment for construction of monitoring system for 4 Branch isolation		
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Equipment for project operation (Minibus, Pick-up, Photocopy machine)		
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.			
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8 The action team conducts measures for reducing surface leakage (visible leakage).			
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12 The action team conducts measures for reducing high water pressure.			
3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	4 Facility provision		
3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.	Flow-meter Chambers (4) for Pilot areas		
3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.	Flow-meter Chambers (23) for Monitoring System		
3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.	Monitoring System for 4 Branch isolation		
3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.			
3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.			
4-4 Chambers are constructed as appropriate.			
4-5 System input to each of 4 branches is measured.			
4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 9
Dated November **, 2021

Project Title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs	Plan / Actual	1st Year (16/17) I	1st Year (16/17) II	1st Year (16/17) III	1st Year (16/17) IV	2nd Year (17/18) I	2nd Year (17/18) II	2nd Year (17/18) III	2nd Year (17/18) IV	3rd Year (18/19) I	3rd Year (18/19) II	3rd Year (18/19) III	3rd Year (18/19) IV	4th Year (19/20) I	4th Year (19/20) II	4th Year (19/20) III	4th Year (19/20) IV	5th Year (20/21) I	5th Year (20/21) II	5th Year (20/21) III	5th Year (20/21) IV	6th Year (21/22) I	6th Year (21/22) II	***Remarks***		
Expert		7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12			
Chief Adviser/Non-Revenue Water Management (Otani)	Plan	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■	■			
	Actual	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■	■			
Adviser/Non-Revenue Water Management (Higuchi)	Plan	■	■	■	■	■	■	■	■																	
	Actual	■	■	■	■	■	■	■	■																	
NRW Reduction Plan 1(1)(Suzuki/Yamaguchi/Toyoda)	Plan	■	■	■	■	■	■	■	■	■	■	■														
	Actual	■	■	■	■	■	■	■	■	■	■	■														
NRW Reduction Plan 1(2)(Yoda)	Plan	■	■	■	■	■	■	■	■	■	■	■														
	Actual	■	■	■	■	■	■	■	■	■	■	■														
NRW Reduction Plan 2(1)(Toyoda)	Plan	■	■	■	■																					
	Actual	■	■	■	■																					
NRW Reduction Plan 2(2)(Tsutsui)	Plan	■	■	■	■	■								■						■	■	■	■			
	Actual	■	■	■	■	■									■					■	■	■	■			
Geographic Information System: GIS (Horishita)	Plan	■	■																							
	Actual	■	■																							
Hydraulic Analysis (Ooe)	Plan	■	■																							
	Actual	■	■																							
Leak Detection (Takahashi)	Plan			■	■				■	■																
	Actual			■	■			■	■																	
Pipe Repairing and Service Connection(1)(Momozono)	Plan				■	■			■	■																
	Actual				■	■			■																	
Pipe Repairing and Service Connection(2)(Takashima)	Plan			■	■																					
	Actual			■	■																					
Information and Communication Technology: ICT (Brouwer, Otani)	Plan	■	■	■	■																					
	Actual	■	■	■	■																					
Long Term Expert (Mayusumi)	Plan					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
	Actual			■	■	■	■	■	■	■	■	■	■	■	■	■	■			■	■					
Equipment																								Handed Over		
Lot 1: Equipment for training on pipe repair and service pipe connection	Plan	■	■	■																				Feb. 28, 2019		
	Actual		■	■	■																					
Lot 2: Pilot Projects (Gate valve, flow meter, and customer meter)	Plan	■	■	■																				Feb. 28, 2019		
	Actual		■	■	■																					
Lot 3: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.)	Plan	■	■	■																				Feb. 28, 2019		
	Actual		■	■	■	■																				
Lot 4: Equipment for survey (Mobile GPS, Potable Test meter etc.)	Plan	■	■	■																				Feb. 28, 2019		
	Actual		■	■	■	■																				
Lot 5: Pipe and related fittings for service pipe replacement in Kadobogo	Plan	■	■																					Feb. 28, 2019		
	Actual		■	■																						
Lot 6: PRVs and Float Valves for Additional Activities	Plan													■	■									Nov. 26, 2020		
	Actual														■	■										
Lot 7: Potable Test Meter (26 sets)	Plan														■	■								May 21, 2020		
	Actual															■	■									
Lot 8: Water level meter, Pressure senser with datalogger	Plan																							Nov. 26, 2020		
	Actual																■									
Lot 9: Engine pump and bulkmeter for emergency water supply for COVID-19 response	Plan																							This will be handed over to WASAC		
	Actual																		■							
Lot 10: Equipment for intermittent water supply for COVID-19 response	Plan																							This will be handed over to WASAC		
	Actual																			■	■	■	■			
Lot 11: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)	Plan	■	■	■										■	■	■									This will be handed over by JICA to WASAC	
	Actual		■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■				
Lot 12: Vehicles and photocopy for Japanese experts	Plan	■	■																					Photocopy will be handed over to WASAC	Vehicles will be returened to JICA in November, 2021	
	Actual		■	■																						
Training in Japan																										
15 persons will be trained in Japan (5, 5, 5)	Plan			■		■	■																	Done		
	Actual			■		■	■																			
In-country/Third country Training																										
2 persons will be trained in Kenya	Plan																							Done		
	Actual								■																	

Activities	Plan / Actual	1st Year (16/17) I	1st Year (16/17) II	1st Year (16/17) III	1st Year (16/17) IV	2nd Year (17/18) I	2nd Year (17/18) II	2nd Year (17/18) III	2nd Year (17/18) IV	3rd Year (18/19) I	3rd Year (18/19) II	3rd Year (18/19) III	3rd Year (18/19) IV	4th Year (19/20) I	4th Year (19/20) II	4th Year (19/20) III	4th Year (19/20) IV	4th Year (19/20) I	4th Year (19/20) II	4th Year (19/20) III	4th Year (19/20) IV	6th Year (21/22) I	6th Year (21/22) II	Achievements	Issue	Countermeasures
Sub-Activities	Actual	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12			
Output 1: Planning capacity of NRW reduction of WASAC is																										
1.1 A management team is organized to prepare 5YSP for NRW reduction.	Plan	■																						Members of the Team were appointed in August 2016. Some change in September 2017.	None	None
	Actual	■				■																				
1.2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and outside Kigali city (14 branches), and identifies problems.	Plan		■																					Questionnaire survey, Site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems.	None	None
	Actual		■	■	■																					
1.3 Based on the problems identified, the management team proposes NRW reduction measures by WASAC in the future.	Plan		■																					Discussion in a series of Workshops. Framework of Action Plan was approved in the seminar on May 29, 2017	None	None
	Actual		■	■																						
1.4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan			■	■	■	■							■	■									Inventory survey was done for all Kigali distribution reservoirs and the bulk meter survey was done for all most all WTPS.	The number of facilities to be surveyed is huge and the resources are limited.	The priority was done to distribution reservoirs in Kigali and bulk meters assessment in almost all WTPs. As way forward, the survey method will be incorporated into NRW reduction manual. Dissemination will be done for all branches and WTPs in order to conduct the survey by themselves. Following quantity surveies by Branch will be conducted. ・Reservoirs survey ・Bulk meter assessment ・Distribution pipe for replacement ・Service pipe for replacement ・PRV installation survey As the result, the equipment procurement quantity to be carried out in 5YSP will be clarified.
	Actual			■	■	■	■							■	■											
1.5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP	Plan					■																		Draft Final report of 5YSP was approved at the second SC on Oct. 12, 2017	None	None
	Actual					■	■																			
1.6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan					■																		The organizational gaps have been identified through the implementation of the 5YSP.	It is necessary to consider organizational reform to promote the implementation of 5YSP. For example, the review WASAC structure to be more responsive and efficient.	WASAC management recognized the importance of the organizational change and the re-structuring process is on-going. Based on the proposal at 5YSP, WASAC is currently entrusted with a consultant. Applying for the following increase in the 5YSP update report. ・Quick and quality repairs, for Kigali Branch (1engineer and 2 technicians) ・Inspection and enforcement of water theft, for NRW unit (2 officers and 3 operators) ・Recruitment of staffs for NRW unit (2 engineers and 3 operators)
	Actual					■	■																			
1.7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Plan					■																		A yearly implementation schedule for each specific actions and its priority were prepared.	None	None
	Actual					■	■																			
1.8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan					■																		Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX) NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. Some activities align with 5YSP implementation are also being considered. Budget for CAPEX are being considered in the revised 5YSP.	Insufficient annual budget doesn't not yet cover most of NRW reduction activities. CAPEX required for the NRW reduction seems to be huge compare to current available budget.	WASAC should think about other sources of funds to support NRW reduction activities (OPEX and CAPEX).
	Actual					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
1.9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan					■																		5YSP was officially approved by the Board of Directors on April 27, 2018.	None	None
	Actual						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
1.10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Plan					■																		5YSP was shared at the SC on October 12, 2017. Approved 5YSP by both management and BoD. Explained at each Branch from April to July 2018. Workshop was held on July 19, 2018	None	None
	Actual						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
1.11 The management team facilitates implementation and the monitoring of the 5YSP.	Plan													■	■	■	■	■	■	■	■	■	■	Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018. Monitoring has being conducted from 2018/19 at every Q by monthly report.	None	None
	Actual									■	■	■	■	■	■	■	■	■	■	■	■	■	■			
1.12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	Plan									■	■													The New Connection Policy was formulated in January 2019 as a revised version of the Requirements for Water Distribution and House Connection due to the emergency to comply with the regulatory agency (RURA).	Later, it was observed the need to revised again the new connection policy in order to ensure customers procured material are good quality. Because it have been confirmed that most of leaks are coming from service pipes (poor quality). The gap between the policy and its implementation is still also a problem.	WASAC should review the new connection policy and the enforcement of its implementation. New connection policy will be proposed in the next technical cooperation project.
	Actual									■	■															
1.13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan										■	■					■	■	■					Budget of WASAC Action Plane was approved.	Budget is not sufficient for implementation for all activities of 5YSP.	Same as 1.8
	Actual											■										■				
1.14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Plan										■								■					Not yet	None	Hold seminars
	Actual																						■			
Output 2:Basic knowledge, skills and technique on NRW control are acquired by WASAC.																								Achievements	Issue	Countermeasures
2.1 Training materials on NRW control are prepared.	Plan	■	■																					Done	None	None
	Actual	■																								
2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.	Plan		■																					Done Each training item has been implemented by April 2018.	Capacity Assessment of the new knowledge acquired through training has not yet been conducted	This will be done after the completion of the pilot project.
	Actual		■																							
2.3 OJT is conducted on the updating of GIS data, using available GIS data base.	Plan	■	■																							
	Actual	■	■																							
2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan	■	■																							
	Actual	■	■																							
2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan			■	■				■	■																
	Actual			■	■	■			■																	
2.6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Plan			■	■				■	■																
	Actual			■	■				■																	

2.7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan / Actual				
2.8	Training materials on NRW are reviewed and updated.	Plan / Actual		In two pilot projects, activities were carried out to further master the skills obtained through the training. In addition, based on the training materials used in the activity of Output 2, a NRW reduction manual was created by adding the method of activities practiced in the pilot project.	None	None
2.9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan / Actual		The manual containing training course is ready and in validation process by the technical and commercial directorate.	The expected final result is that the training program formulated by this project will be incorporated into WASAC's human resource development plan, but it has not yet reached that stage despite completion of the manual.	The core person of the dissemination of the manual on NRW reduction activities have been trained in the NRW project. The training can be conducted mainly by NRW Section staff of DUWSS, regardless of the WASAC training course implemented by Supporting Service.

Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

				Achievements	Issue	Countermeasures
A. Preparation						
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Aria 2.	Plan / Actual		Member of the Team were appointed in August 2017	None	None
3.2	The action team grasps the current situations of Pilot Areas through reviewing available maps, customer ledgers, surveys, and other necessary means.	Plan / Actual		Done	None	None
3.3	The action team plans and schedules the implementation of the pilot project.	Plan / Actual		Done	None	None
3.4	The action team hydraulically isolates Pilot Areas, and installs flow meters and pressure gauges at the inlets of the Areas.	Plan / Actual	Procurement of Equipment and Construction of Chamber	Flow meters and pressure gauges were installed in the meter chambers by May 2017.	None	None
B. Activity of Pilot Area 1 Kadobogo						
3.5	The action team establishes the baseline NRW rate of Pilot Area.	Plan / Actual		Baseline: Mean value of June, July 2017 NRW Rate is: 37.3%	None	None
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA).	Plan / Actual		The existing 327 customer meters were replaced with the new one by the result of on-site meter test (total surveyed 1,172).	None	None
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual		Effect was evaluated on three comparisons cases of before and after replacement. 1. Total meter error , 2. Consumption volume of replaced meters.	None	None
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan / Actual		Done	None	None
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual		Done	None	None
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan / Actual		Done	Some leak detection equipment not appropriate for the majority of the existing water network condition (lack of some facilities such as valves, etc.)	Use those equipment efficiently where they can be applied more training on sophisticated one.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual		Done	None	None
3.12	The action team conducts activities for reducing high water pressure.	Plan / Actual		PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block. PRV at PM1 was set in September 2019.	PRV of PM3 lost function from May 2019. So the NRW rate of PM3 increased rapidly. The importance of maintenance after PRV installation was recognized. It is necessary to periodically check the pressure setting value of the PRV. The PRV was newly replaced in 2020.	None
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan / Actual		The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.	Planned pilot activities in the pilot area were completed, although some equipment's (Bulk meter , 2 PRVs) were defected. The replacement took time because of limited maintenance budget from the project and WASAC.	For the sustainability of NRW reduction, it should be continued to monitor the Pilot area (reading index, calculation of the NRW, progress). WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities using lesson learned from the Project.
C. Activity of Pilot Area 2 Ruyenzi						
3.5	The action team establishes the baseline NRW rate.	Plan / Actual		Baseline: Mean value of March, April 2018 Original: 68.4%	None	None
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) .	Plan / Actual		General meter visual inspection for all customers 1,703 was conducted. In this, 135 were replaced by the result of on-site meter test.	None	None
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan / Actual		The result of meter test shows that the effect of meter replacement was minus but quite negligible.	None	None
3.8	The action team conducts activities for reducing surface leakage (visible leakage).	Plan / Actual		Large quantity of the existing leakage was measured. Visible leakages were found at 16 places in March, 14 places in July and August.	None	None
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan / Actual		Done	None	None
3.10	The action team conducts activity for reducing underground leakage (invisible leakage).	Plan / Actual		Step test was conducted during may to July 2019.	Invisible leakage could not be found because of complexity of the existing network.	Pressure reduction was required for control of underground leakage.
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan / Actual		Qmnf measurement was conducted during June to September 2019.	The result shows that most critical area of leakage is high pressure area by bypass of the Ruyezi reservoir.	Pressure reduction was required for control of underground leakage.
3.12	The action team conducts measures for reducing high water pressure	Plan / Actual		Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept. , one in RY2 in Oct., 2018. Additionally, one each in RY1 and RY3. Ball valve in RY1.	None	None
3.13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan / Actual		The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.	Planned pilot activities in the pilot area were completed, although some equipment's (Bulk meter , 2 PRVs) were defected. The replacement took time because of limited maintenance budget from the project and WASAC.	For the sustainability of NRW reduction, it should be continued to monitor the Pilot area (reading index, calculation of the NRW, progress). WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities using lesson learned from the Project.
D. Report, Manual and Seminar						
3.14	The team reviews the results of Activities, and undertakes cost-benefit analysis of NRW for each Activity.	Plan / Actual		The cost-benefit analysis was done based on the NRW rate measured until January 2020. The calculation of the NPV and B/C values clearly shows the effect of NRW reduction activities. In conclusion, the investment in NRW reduction activities had sufficiently effect when the activities reduced the NRW rate to a certain degree (by approx. 10%) even if the rate was very high like a Ruyenzi (68%).	In Pilot areas (Ruyenzi), the target value (25%) could not be achieved, due to poor quality water pipes and high pressure.	Continue NRW reduction in Pilot Area 2 with more attention. Replacement of small-diameter HDPE pipes with high leakage should be conducted. Materials have been procured in response to Covid-19 prevention measures, and WASAC should replace existing pipes as soon as possible. .
3.15	The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project, and submits it to the management team.	Plan / Actual		Draft of completion report was completed in October for Pilot1 and February, 2020 for Pilot 2.	None	None
3.16	The action team holds a workshop and presents the completion report of the pilot project prepared to WASAC.	Plan / Actual		Not yet	None	Hold seminars
3.18	Action team prepares manuals on methods and use of survey equipment learned from the pilot project, and holds seminars in order to share them with WASAC.	Plan / Actual		Same as 2.8	same as 2.8	Same as 2.8
3.19	Action team disseminates the manual and use of survey equipment to the activity of whole branches.	Plan / Actual		Not yet	None	None

Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.

				Achievements	Issue	Countermeasures
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan / Actual		Done	None	None
4.2	Based on the isolation plan, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan / Actual		Done	None	None
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.	Plan / Actual		The installation was completed at the beginning of September. Training of the NRW rate calculation is on going.	WASAC task has not yet completed.	To replace default meters installed in SUSWAS project and meters for new closing point at an early time. Train WASAC team to properly operate the installed NRW monitoring system.
4.4	Chambers are constructed as appropriate.			23 meter chambers have been constructed	None	None
4.5	System input to each of 4 branches is measured.	Plan / Actual		This work will carry out after completion of the monitoring system (installation of flow meters)	delay of completion of the monitoring system	same as 4.4
4.6	Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.	Plan / Actual		Ditto	Ditto	Ditto

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Monitoring Plan	Plan / Actual	1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)				4rd Year (19/20)				5th Year (20/21)				6th Year (21/22)		Remarks
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	
		7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	1 2 3	4 5 6	7 8 9	10 11 12	
Monitoring																								
Steering Committee	Plan	■		■		■			■	■			■	■									■	
	Actual				■		■			■			■			■					■			■	
Set-up the Detailed Plan of Operation	Plan	■			Apr. 4	■		Oct. 12		■			■	May 22		Feb 4	■			Apr 27					
	Actual	■				■				■			■											
Submission of Monitoring Sheet	Plan		■	■		■				■						■								
	Actual	■		■	■	■				■		■	■		■		■				■	■		
Monitoring Mission from Japan	Plan									■			■				■							
	Actual									■			■											
Joint Monitoring	Plan	■						■		■							■							
	Actual			■		■				■			■										■	
Post Monitoring	Plan																							
	Actual																							
Reports/Documents																								
Progress Report	Plan				■				■				■											
	Actual				■				■					■				■		■					
Project Completion Report	Plan																						■	
	Actual																							
Public Relations																								
Seminars and Workshops	Plan				■				■				■				■							
	Actual				■		■																	

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